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Volume 8 AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852 *Number 12*

DECEMBER 1938

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Arthur E. Morgan has had 36 years' experience in water-control engineering work—as president and director of his own company, as chief engineer for the Miami Conservancy District, and as chairman of the board, Tennessee Valley Authority. He was also for a number of years president of Antioch College.

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Something to Think About

A Series of Reflective Comments Sponsored by the Committee on Publications

Engineering Demands Conclusive Analysis

By ARTHUR E. MORGAN

MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS

WHEN an engineer is called on to solve an engineering problem, he commonly finds more than one way to secure the desired result. Before committing himself to a specific solution he must discover and compare the various possibilities, and must decide which one will best serve the purpose. Very often the weakest phase of engineering is not in refinement and accuracy of planning, but in this preliminary process of determining the general character and design of an engineering undertaking. Repeatedly I have seen competent work being done in the details of planning, when there had been failure at the outset to make sure that the general type of improvement selected was the best of all the various possibilities. Very often some controlling possibility had been overlooked, which, if recognized and made use of, would have resulted in major changes in the general type of design, with striking savings or increase in value.

Conclusions May Be Drawn Too Quickly.~In most of the day-by-day decisions which an active engineer is called upon to make, the primary need seems to be to reach a conclusion, to keep things going, to maintain a schedule. His training emphasizes specific design. If the habit of disposing of uncertainties is not sufficiently well developed, his employer or client will impress it upon him. Because of the cumulative effect of all such influences, it is natural that this temper of quickly arriving at practical conclusions often comes to control the mental set of the successful engineer, and tends to determine the character of all his actions. A practical, unimaginative engineer may even get a feeling of satisfaction from this attitude, and of contempt for any other.

IT is human nature to want to dispose of preliminaries and begin the actual work of "getting things done." Hence, says Dr. Morgan, the weakest phase of engineering is often in the determination of the general character of a project, rather than in the details of its design. He urges the importance of conclusive analysis—analysis that takes into account all the possibilities—even in jobs that are ordinarily considered routine. This editorial is an abridgment of his address at the 37th Convention of the Tau Beta Pi Association, at Cincinnati, October 6, 1938. The full text appears in the current issue of "The Bent of Tau Beta Pi," whose courtesy in permitting the present use of it is gratefully acknowledged.

Different fields of engineering are subject in different degrees to this failing of overlooking some possibility that would have supplied the best solution. The less standardized the field, the greater is the likelihood that this will occur. In my own field of flood control, for example, this need for conclusive analysis of possibilities is especially great. As a rule only the end result—relief from floods—is predetermined. Within that general purpose the engineer is responsible for appraising every possibility and for selecting the particular method or combination of methods which, everything considered, will provide the best total of results in minimum cost and maximum value.

Sometimes a considerable variety of possibilities present themselves—channel improvements, levees, cut-offs, by-passes, reservoirs, walls, diversions of part of the watershed, or evacuation of the flood plain. Combinations of different methods often are possible. In such cases determination of the ultimately best solution will seldom be found by hit-or-miss trials. An orderly process is necessary.

But, strange as it may seem, very frequently there is lacking any definite policy for insuring that every significant possibility has been explored, or failure to carry such a process through to a definitive conclusion. Conventional solutions may be uncritically adopted, or a few obvious comparisons may be made, and then, on the basis of such inconclusive selection, a decision may be made and final designs begun. When such an inadequate course is followed it may be not because of any compulsion of outward circumstance, but as a result of the mental set of those responsible for the determination of plans.

Now, it will not save a situation

like this to turn it over from men of action to men who are temperamentally indecisive. Every experienced engineer knows what that means to the progress of a great undertaking. What engineering needs is not so simple as the striking of a balance between men of decision and action on the one hand, and men of a research temperament on the other. There is needed in engineering a consciously developed and organized discipline and technique for conclusive analysis.

Edison's Method.~Some years ago I asked Thomas A. Edison whether he had any general policy or theory which he followed in undertaking the solution of a problem. His answer so clearly describes the general principle I am discussing that I shall endeavor to repeat what he told me. I have forgotten his exact words, but I can best transmit his idea by speaking as though I were quoting him.

"First," Mr. Edison said, "I clearly define my problem, just what it is I wish to accomplish. I write down the problem as I see it, both as a matter of record, and the better to define my ideas.

"Then I take up the most obvious solution—often what I might call a 'hunch.' I work it out just as though it were the one I were going to adopt, to the point where I have it well thought out and well stated. Then I write it down in orderly form.

"When that is done I take up the next most obvious solution, and in turn every other possible solution which occurs to me, and treat them in the same way. If a solution proves definitely to be impossible, I do not waste time on it, but I do make a record of it, especially of any feature that might be used as an element in some other solution.

"Next, I may search the literature for methods others may have used. As these possibilities are exhausted, I turn back to my notes to see whether by contrast they may not suggest some strikingly different method of approach. Then I try to make new combinations of the different elements that appear in my various solutions.

"Finally, I begin to compare what seem to be the best solutions with what seem to be the worst. Little by little, by a process of careful comparison, the poorer elements and the poorer solutions are discarded, until finally the issue boils down to one or a few solutions."

I asked Mr. Edison how many tentative solutions he might have and he said, "Sometimes as many as thirty or forty," and he added that his first hunches seldom turned out to be the best solutions.

Thomas Edison's description illustrates a general philosophy of approach to the solution of an engineering problem, though its informality may be subject to criticism. In some fields of engineering a much more formal and definitive process of analysis is possible.

Intangibles Must Be Analyzed.~I am not greatly impressed by the criticism that many factors may be intangible and not subject to engineering analysis. Every engineering decision is the conclusion of an analysis, either conscious or intuitive. Part of that process of analysis often consists in reducing supposed intangibles to common terms, such as money value. In the engineer's work even the economic expenditure which is justified in saving a certain number of human lives must be reduced to dollars. The elimination of a hundred railroad grade crossings will save so many lives in a decade. Counting lives and considering relative convenience, is it better to spend the definitely limited money available on elimination of grade crossings, or on sewage disposal, or on elimination of contagious disease? One of the necessary disciplines for the engineer is to face the issue of conclusive analysis with his best efforts, rather than to reach his conclusions on vague hunches on the ground that he is dealing with intangibles.

I should not advise an engineer to ignore his intuitions, and there are times when his intuitions should prevail over the best efforts he can make toward formal analysis. His intuitions unconsciously sum up his total experience, including factors that may not come to his conscious attention. But his intuition or informal judgment should be tested as far as possible by formal analysis.

It is not only in the working out of over-all plans for great projects that conclusive engineering analysis is useful. It is desirable, also, to apply that process in determining the general character of various major phases of a plan, and even down to the selection of minor elements.

Thorough application of the principal of conclusive engineering analysis may increase the cost of engineering. At least in the less standardized fields, the habit of estimating the proper cost of preparing plans as a certain percentage of the cost of the completed job may have pernicious results, in that it tends to discourage thorough planning, and sometimes makes such planning wholly impossible.

Application to Routine Jobs.~Almost every engineer at some point is given responsibility for securing the best possible engineering results by the best methods he can devise. This holds true even in the case of seemingly routine processes. Several years ago I had some surveying parties taking topography. This seemed to be a routine job, but one of the topographers made it an occasion for thoroughgoing analysis. By the methods he developed he more than doubled the average day's work of his party. No matter where an engineer works, a penetrating analysis of his job usually shows that previous results have been far from the best that are possible.

In my opinion, the principle of conclusive engineering analysis should have formal recognition in engineering education. Such teaching should include the arousing and disciplining of imagination. Whoever cannot or will not develop that kind of imagination is *ipso facto* incapacitated for important phases of engineering responsibility.

There is room in many fields of engineering for the specialist whose outstanding ability is creative imagination, akin to invention, disciplined by engineering principles and experience, and who can use that special ability with such order and restraint as not to become the despair of those who are responsible for bringing plans to fruition. Such men should be sought out and encouraged, and should be given such contacts and responsibility as will result in imbuing engineering organizations with the spirit of exploration and comparison.

Wherever an engineer works, and in whatever capacity, in so far as the magnitude of the issues makes it reasonably possible, he should take the job before him, and so thoroughly explore, appraise, and compare all of its general possibilities that the type of plan he adopts will be conclusively the best that is available to him.

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DECEMBER 1938

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Concrete for the Kanawha River Project

Review of Design and Control Procedure Employed, with Special Reference to Effect of Coarse Grinding and Tri-Calcium Content on Strength and Heat Generation

By JOHN C. SPRAGUE
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REDUCING the heat generated in concrete on setting may be effected by using either coarse-ground cement or cement with a low content of tri-calcium compounds. By close field control and an extensive program of testing, government engineers on the Kanawha River Recanalization Project succeeded in obtaining considerable practical information on the merits of both methods and the strength of the resulting product. These investigations are reported in the accompanying paper, which also describes briefly the mixing and placing methods employed on the project.

RECANALIZATION of the Kanawha River in West Virginia involved the construction of four roller-gate navigation dams[1] containing a total of 820,000 cu yd of concrete. The present paper is a review of the concrete design and control procedure employed, and a summary of the more outstanding results obtained, in connection with this construction program.

The four new dams replace 13 smaller ones—3 on the Ohio River and 10 on the Kanawha River—and increase the channel depth of the latter from 6 to 9 ft. The last of these structures to be built, the Gallipolis Locks and Dam, is on the Ohio River, 13 miles below the mouth of the Kanawha. It was completed in October 1937. The other three—Winfield Locks and Dam, Marmet Locks and Dam, and London Locks and Dam—are on the Kanawha itself and are, respectively, 31, 68, and 83 miles above its mouth. The dams on the Kanawha have twin navigation locks, each 56 ft in width and 360 ft long, while the Gallipolis project has two lock chambers 110 ft wide, and 360 and 600 ft long, respectively—conforming with the navigation requirements of the respective streams. The lock walls at Gallipolis extend approximately 58 ft above rock and the piers for the dam about 110 ft.

Federal Specification SS-C-191 for portland cement, issued October 14, 1930, was used throughout the construction program, with the following exceptions:

1. For construction of the Gallipolis and Winfield locks it was stipulated that a minimum of 15 per cent be retained on a standard No. 200 sieve;
2. For construction of the Gallipolis and Winfield dams, it was stipulated that the cement contain not more than 55 per cent tri-calcium silicate ($3CaO.SiO_2$) nor more than 8 per cent tri-calcium aluminate ($3CaO.Al_2O_3$). A reduction of 25 lb per sq in. was allowed in tensile strength requirements, because of these limitations in compound composition.

These stipulations were made with a view toward reducing heat generation in the cement. Controlling the amount of heat generation by controlling the total amount of the tri-calcium compounds is considered more effective than is the use of coarse ground cement.

Ohio River sand and gravel were used as aggregates. Figure 1 shows the average grading and other physical characteristics of aggregate used in the construction of the Winfield and Gallipolis dams. Similar grading was used in the other projects, except that 2 per cent fines passing the No. 100 sieve was not specified. The sand was slightly coarse, and the gravel comparatively fine; however, the grading used is considered optimum from the standpoints of quality and economy, for river conditions in the District. At times considerable difficulty was experienced in obtaining the 2 per cent fines passing the No. 100 sieve, required in constructing the Gallipolis and Winfield dams; at such times it was necessary to use an admixture in lieu of the natural fines, the quantity being determined by a special workability test.[2]

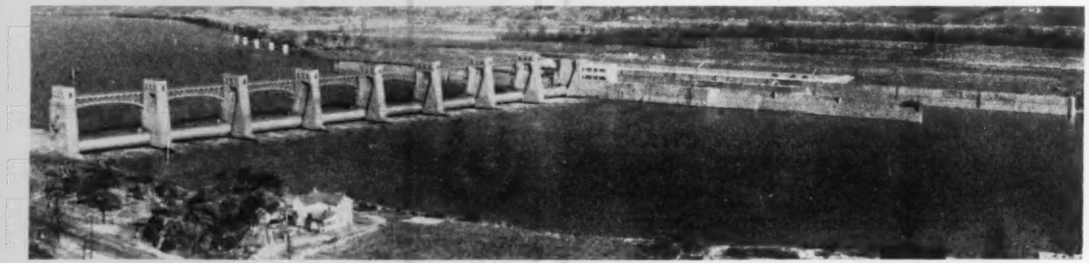
Concrete mixes for the bulk of the concrete (Class B) were based on a minimum cement factor of 1.25 (5 sacks per cu yd) for all projects except the locks at Gallipolis and Winfield, where the cement factor was 1.125; and on a maximum water-cement ratio of 0.867 (6.5 gal per sack). The cement content for Class A concrete, used in all thin and reinforced sections, was increased 1 sack per cu yd and the water-cement ratio reduced to a maximum of 0.733.

The actual design of mixtures was based on optimum density of concrete,[3] all materials being calculated on the basis of absolute volume and then changed to field weights. All quantities of materials entering the concrete mixtures were carefully controlled in order to ensure that the contractor would obtain as near 100 per cent yield as possible. The average yield for the 820,500 cu yd of concrete placed is approximately 99.7 per cent.

MIXING, POURING, AND CURING

Cement was delivered to the job in bulk by barge or rail, and transferred by pneumatic handling equipment to the storage bins. Aggregates were delivered by barge and hoisted by whirler derrick to large bins on the mixing plant. Both cement and aggregate were fed by gravity from these bins to the measuring hoppers. Mixing water was pumped directly from the river.

Stationary mixing plants were used in the construction of locks, and floating plants were used for the dams. In each case the plant contained two 2-yd mixing drums, and the minimum mixing time was 2 min.



GENERAL VIEW OF THE COMPLETED GALLIPOLIS PROJECT

During construction of the locks, except in one case, concrete was conveyed by gasoline dinkey from mixing plant to forms in 2-yd bottom-dump buckets. (In the riverward lock at London, the concrete was delivered by belt conveyor.) In general, the buckets were of the well-known square type; during the past three or four years, however, circular buckets have also been used and have been found to give much better performance because of their shape, particularly in close form work. The buckets were handled by whirler derrick and the concrete placed as nearly in final position in the forms as possible. Electric vibrators ranging in speed from 3,600 to 7,200 rpm were used to compact the concrete for the Gallipolis and Winfield projects, the higher rate of speed producing the better results. The same general procedure was followed in constructing the dams, except that the use of the gasoline dinkey was not necessary.

In general, the concrete was placed on rock foundations, on a bed of mortar. The lifts varied from 4 to 20 ft in height, and the distance between vertical construction joints was from 20 to 50 ft. Just before starting each succeeding lift the old concrete surface was thoroughly cleaned by wire brushes and air-water jets, and covered by a thick cement paste or by a bed of mortar about one inch thick.

In general, forms were stripped 48 hours after placing of concrete. However, under exceptional circumstances forms were stripped somewhat sooner to expedite the work. There were other cases when the contractor was required to keep the forms in place for a period exceeding 48 hours. Any deviation from the specified time of 48 hours was determined by strength tests.[4]

Continuous wet curing for from 10 to 14 days was required by the specifications. Several methods were used, but that found most satisfactory and most economical was the installation of perforated galvanized pipes along both sides at the top of each lift. A continuous spray from these pipes, properly located, kept the entire top and faces of the monolith thoroughly wet.

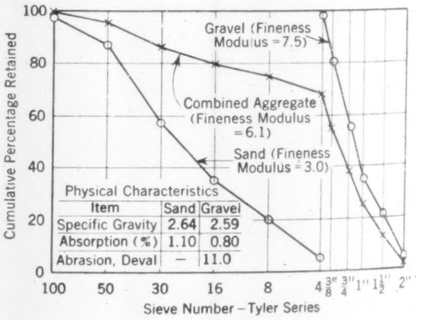
Special precautions were required in handling and curing concrete placed when the atmospheric temperature dropped below 35 F. When this condition prevailed, it was required that concrete be delivered to the form at a temperature between 50 and 100 F, and that the ambient temperature about the concrete be maintained at 50 to 100 F for not less than 5 days following the pour. To bring the concrete to the required temperature, it was found necessary to heat only the mixing water, to approximately 150 F. Curing temperatures were maintained by a system of steam pipes near the surface of the concrete, the whole being covered with tarpaulin.

The tops of lifts were finished to line and grade by wood float. Smooth-surface pressed-board forms were used at Marmet and London for the walls of operation and pier houses. This practice was not followed at Gallipolis and Winfield, where tongue-and-groove forming was used instead and the surface of the concrete was rubbed after the forms were removed.

8,000 TEST CYLINDERS PROVIDE STRENGTH DATA

The compressive strength of 6 by 12-in. standard cured test cylinders made at the various projects is shown in Fig. 2, the curves being based on a total of approximately 8,000 specimens. The more pronounced gain in strength at later ages for concrete placed in the Gallipolis and Winfield dams is believed to be a direct result of the higher percentage of di-calcium silicate ($2CaO.SiO_2$) in the cement used on those projects. The $2CaO.SiO_2$ content in cement used on the other projects was comparatively low (with the exception of Marmet Lock A), the $3CaO.SiO_2$ and $3CaO.Al_2O_3$ contents being correspondingly high. For example, cement used in the locks of the Gallipolis and Winfield projects had a 13 per cent higher tri-calcium content, and a 9 per cent lower di-calcium content, than did cement used in the dams; and the curves show how this was reflected in the compressive strengths. In comparing the strength curves on the basis of water-cement ratio, it should be kept in mind that the types of cement differed widely. For instance, because of coarse grinding of the cement used in the Gallipolis and Winfield locks, the effective water-cement ratio would be increased to approximately 0.90 and 0.94, respectively, since cement retained on a No. 200 sieve generates practically no strength.

In Fig. 3 are plotted the strengths of 6 by 12-in. concrete cores drilled from Winfield Dam at the age of 28 days, and tested for compression. The strength of companion standard-cured cast cylinders is also shown. It is interesting to note that the strength of the concrete is considerably lower at the surface than in the interior, and that the strength increases progressively with depth, up to the 5-ft maximum depth drilled. The lowered strength at the surface reflects a higher effective water-cement ratio and less favorable curing conditions, and is in general agreement with results obtained by Krefeld.[5] From this investigation it is concluded that standard cured cylinders are indicative of the strength of concrete in a structure only at some given depth from the surface, the depth in this case being approximately 3.8 ft.



Physical Characteristics

Item	Sand	Gravel
Specific Gravity	2.64	2.59
Absorption (%)	1.10	0.80
Abrasion, Deval	—	11.0

FIG. 1. AVERAGE SIEVE ANALYSIS AND CHARACTERISTICS OF AGGREGATE

Tests to determine temperature rise in concrete on the Gallipolis project were initiated in July 1934 and completed in April 1937. Temperature wells, approximately $1/2$ in. in diameter and varying in depth from 5 to 10 ft, depending on the wall thickness, were cast in the concrete by means of suitable rods which were removed when the concrete had attained its initial set. Electrical resistance thermometers were then installed, and temperature readings taken periodically until the temperature of the concrete approached prevailing ambient temperature. Seventeen resistance thermometers were placed at a 10-ft depth, and 30 at depths of 5 and 8 ft from exposed surfaces. Table I shows comparable average characteristics of the cements used, and presents average temperature-rise data for both the locks and the dam.

TEMPERATURE-RISE DATA ANALYZED

A comparison of temperature-rise data for concrete placed in the locks, where coarse-ground cement was used, and in the dam, where a modified normal-ground cement was used, bring out several points of interest. Analysis of temperature-rise curves, cement data, and concrete-mix designs have made it possible to compare results on a common basis for the two types of cement.

Percentages of $3CaO.SiO_2$ and $3CaO.Al_2O_3$ in cement used in the locks are appreciably higher than for cement used in the dam. (On an average, the combined percentage is about 13 per cent higher.) Inasmuch as these are the high-heat and high-early-strength producing compounds in portland cement, it would be expected that the temperature rise and early strength of the concrete in the locks would be higher than for the dam. Going a step further, however, it is seen that the cement in the dam is considerably more finely ground than that in the locks—that is the cement in the dam has a greater percentage passing the No. 200 sieve. This would indicate that the temperature rise and early strength of the concrete in the dam would be higher than that in the locks.

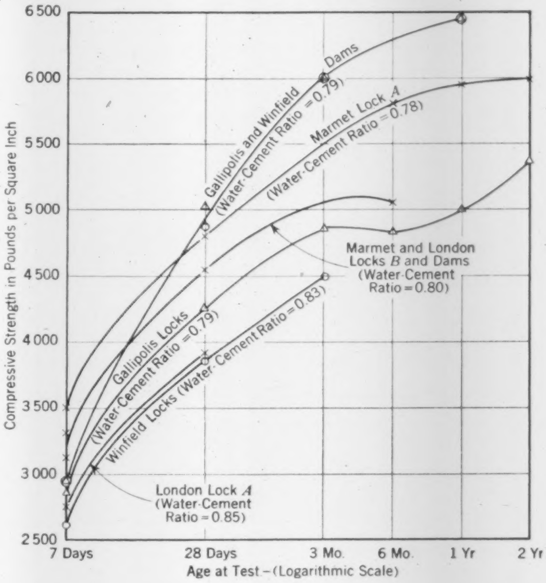


FIG. 2. AGE-STRENGTH RELATIONSHIP OF CONCRETE IN THE STRUCTURES

From these considerations it is evident that there is nothing contrary to established concepts in the tensile strength results. The average tensile strength at 28 days for the cements in the dam is 430 lb per sq in., which is only about 15 lb per sq in. higher than the average for the locks. From this it may be seen that the greater proportion of high-strength-giving compounds in the locks is balanced by the greater fineness of the cements in the dam (Table I), to produce practically equal tensile strength in the two cases.

A comparison between individual cements brings out this relationship very clearly. The tensile strength of Cement A was higher for the locks—where its tri-calcium content was 19.8 per cent higher than for the dam, and its percentage passing the No. 200 sieve was only 8.2 per cent lower. On the other hand, the tensile strength of Cement D was 89 lb per sq in. higher for the dam, where its tri-calcium content was 16.7 per cent lower but its percentage passing the No. 200 sieve was 16.8 per cent higher. Cements B and C follow the same trend, showing the potent influence which fineness of grinding has on the strength of cement.

As pointed out earlier, the cement factor for the dam was a half sack per yard higher than it was for the locks, it being 5.0 sacks for the former and 4.5 sacks for the latter. For purposes of comparison in this paper, these are called "nominal" cement factors. "Effective" cement factor equals nominal cement factor times the percentage passing the No. 200 sieve, and is used in order that results for the locks and for the dam may be compared on a common basis. This method of comparison seems justified as a result of tests in which a quantity of cement larger than 200-mesh was obtained and incorporated in 2 by 4-in. mortar cylinders. Results of tests conducted by Eiger[6] furnished the stimulus for initiating this investigation. A negligible amount of heat was generated at 28 days and the specimens were so weak that they could not be stripped for 7 days, the compressive strength at 28 days and at three months being only 300 lb per sq in.

For this reason, and because of the difference in nominal cement factors on the two projects, the so-called effective cement factor is used to reduce the cement factor in both projects to a one-sack mix. Nominal and effective cement factors are given in the table for each brand of cement. Below these values are shown values for average water-cement ratios and compressive strengths for the locks

TABLE I. DATA ON TEMPERATURE-RISE TESTS AT THE GALLIPOLIS LOCKS AND DAM

GALLIPOLIS LOCKS (COARSE GROUND CEMENT) Brands				TYPE OF INFORMATION	GALLIPOLIS DAM (MODIFIED NORMAL-GROUND CEMENT) Brands			
A	B	C	D		D	B	C	A
57.3%	57.0%	49.3%	51.5%	$3CaO.SiO_2$ (C_3S)	48.7%	47.1%	44.1%	46.1%
14.2%	11.4%	11.4%	8.6%	$3CaO.Al_2O_3$ (C_3A)	4.7%	6.3%	5.6%	5.8%
14.0%	15.1%	23.0%	24.1%	$2CaO.SiO_2$ (C_2S)	25.0%	29.9%	27.3%	28.7%
85.7%	79.8%	72.1%	68.7%	$C_3S + 2C_3A$	58.1%	59.7%	55.3%	57.7%
450	422	405	404	28-day tensile strength. lb per sq in.	493	456	441	414
16.5%	17.2%	17.2%	19.1%	200 sieve, % retained	2.3%	5.3%	3.8%	8.5%
4.5	4.5	4.5	4.5	Nominal cement factor	5.0	5.0	5.0	5.0
3.76	3.72	3.72	3.64	Effective cement factor (sacks per cu yd)	4.89	4.74	4.82	4.58
3.7 sacks per cu yd				Average effective cement factor	4.75 sacks per cu yd			
0.79				Average nominal W/C ratio	0.775			
0.94				Average effective W/C ratio	0.815			
4,260 lb per sq in				Average compressive strength (28-day)	5,039 lb per sq in.			
66 F	60 F	57 F	54 F	Temp. rise, 10-ft holes	66 F	63 F	62 F	59 F
58 F	53 F	48 F	47 F	Temp. rise, 5-ft holes	...	62 F	57 F	56 F
106	113	120	135	Hours to max., 10-ft holes	87	86	100	134
89	100	119	138	Hours to max., 5-ft holes	...	70	132	114
0.58 F	0.55 F	0.49 F	0.41 F	Rise per hr, 10-ft holes	0.76 F	0.74 F	0.62 F	0.45 F
0.66 F	0.54 F	0.41 F	0.34 F	Rise per hr, 5-ft holes	...	0.88 F	0.43 F	0.49 F
24	35	21	24	Hrs at peak, 10-ft holes	31	34	20	26
16	39	16	12	Hrs at peak, 5-ft holes	...	15	18	16
0.08 F	0.12 F	0.12 F	0.07 F	Rate of fall per hour	0.09 F	0.12 F	0.08 F	0.07 F
17.6 F	16.2 F	15.3 F	15.0 F	Temp. rise per effective sack cement, 10-ft holes	13.5 F	13.3 F	13.0 F	13.0 F

and dam. The compressive strengths and effective water-cement ratios fall on established curves for the relationship between water-cement ratio and compressive strength.

From a study of the temperature rise it will be noted that the dam shows a 3-deg F higher rise in temperature. Considering only the fact that more cement was used in the dam, and that it was much more finely ground, it would be expected that this difference in temperature rise would be greater. Keeping in mind, however, the fact that the tri-calcium compounds are considerably higher in the cements used for the locks, the very slight difference is not surprising. Going further down the table, we find that it took about 5 hours longer for the lock concrete to reach maximum temperature. The higher rise in the dam and the shorter period of rise are probably due to the fact that the dam cement was more finely ground. It is well known that fineness of grinding tends toward greater heat acceleration in concrete. A study of the data shows that the rate of rise for the dam is higher by approximately 0.18 deg F per hr. On the other hand, the rate of fall is practically the same in both cases, as was the time the temperature remained at the peak.

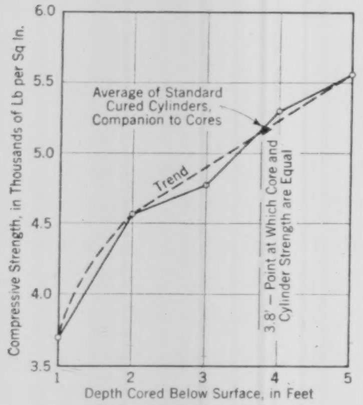


FIG. 3. 28-DAY STRENGTH OF CORES DRILLED AT VARIOUS DEPTHS, AND OF STANDARD-CURED TEST CYLINDERS

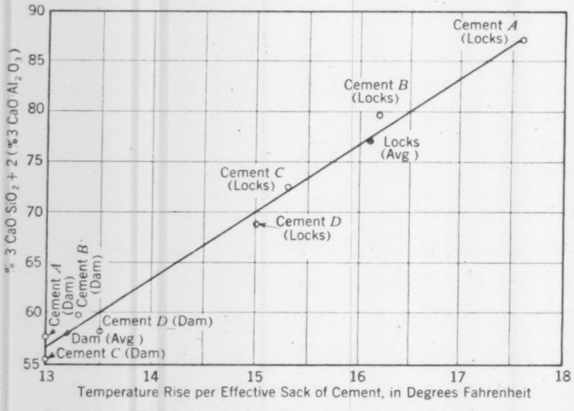


FIG 4. CORRELATION BETWEEN TEMPERATURE RISE IN CONCRETE AND A FUNCTION OF THE TRI-CALCIUM COMPOUNDS

FINAL STEP IN THE COMPARISON

The last step in comparing the temperature rise of concrete in the locks and in the dam is shown at the bottom of Table I and in Fig. 4. The total temperature rise for each of the cements is divided by the effective cement factor (number of sacks of cement passing the No. 200 sieve, per cu yd of concrete); this gives the temperature rise per effective sack of cement per cubic yard of concrete. On this basis of comparison, the temperature rise per sack of cement for the locks is approximately 3 deg F higher than it was for the dam. This is significant because it indicates that a coarse-ground cement was not effective in reducing the temperature rise in the concrete. If the coarse-ground cement had had a more uniform grading than that used in these projects, the results might have been better—assuming, of course, the same chemical composition.

In Fig. 4, the temperature rise per effective sack of cement is plotted against the tri-calcium compounds. Since it is known that $3CaO.Al_2O_3$ generates approximately twice as much heat at 28 days as $3CaO.SiO_2$, the temperature rise is plotted against the function $3CaO.SiO_2 + 2(3CaO.Al_2O_3)$. The value of this function is considered a good index of heat generation in concrete.

The average total temperature (that is, placing-temperature plus temperature rise) reached in the concrete during the summer months was 145 F, and in winter 120 F, which is a normal range under ordinary conditions of placing concrete. The mean annual temperature for this section is around 58 F, and the average prevailing ambient temperature 80 F during the summer months. The time required for the temperature of concrete placed in the summer to drop to the prevailing ambient temperature was about one month, the drop being about 65 F. The drop of approximately 87 F to the mean annual temperature required more than a year. The time required for the temperature of concrete placed during cold weather to drop the 62 deg to mean annual temperature was from two to three months.

A few resistance thermometers were installed in the Winfield Dam, and the results obtained were practically the same as those secured for the Gallipolis project.

At London Dam a number of Fahrenheit thermometers were installed in 2-in. temperature wells cast in the concrete. The average temperature rise at a depth of approximately 7 ft (center of mass of piers) for concrete having a cement factor of 1.25 was 64 F, and for concrete having a cement factor of 1.125, 62.5 F; the average maximum temperature attained in the concrete was 147 F, this peak being reached at from 1.5 to 3 days.

Surface cracks were more severe for concrete placed during warm than during cold weather, probably because of the greater temperature drop from maximum to mean annual. The more pronounced this drop in temperature, of course, the greater the tensile stresses due to contraction. The surface cracks developed in the Gallipolis and Winfield lock walls were more severe than those in the dams, probably because of drying shrinkage, since the cracks appeared at relatively early ages. Since the effective water-cement ratio of concrete in the locks is comparatively high, this is not particularly surprising.

On the whole, the surface cracks that have appeared on the walls of the structures are not considered serious. They do not affect the structural strength, and climatic conditions are not severe enough to cause serious weathering. Further, it is probable that in time calcium carbonate will form and seal the cracks, since the water coming in contact with the structures is not chemically aggressive.

Design and construction of the Kanawha River Recanalization Project were under the direction of the Huntington District Office, Ohio River Division, Corps of Engineers, U. S. Army. During this period, Col. R. G. Powell was Division Engineer, and Lieut. Cols. Fred W. Herman, John F. Conklin, and J. D. Arthur, Jr., were successively District Engineers.

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Precise Levels Run at Night

Innovation in Surveying Methods Proves Its Value in the Tropics

By ROBERT C. SHELDON

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NIGHT-time precise leveling was undertaken for the first time in the recent recheck of the permanent bench marks in the Canal Zone. By this procedure most of the difficulties that beset the surveyor in the tropics—heat waves, glare, and high dry-season daytime winds—were avoided; and the speed and accuracy of the work were increased. Equipment and methods are described, and results evaluated in this article.

THE permanent bench-mark system on the Panama Canal was established in 1908. It consisted of bench marks placed at intervals of approximately one mile along the line of the old Panama Railroad, and additional permanent benches near the main line but with sufficient elevation to be above the proposed Gatun Lake.

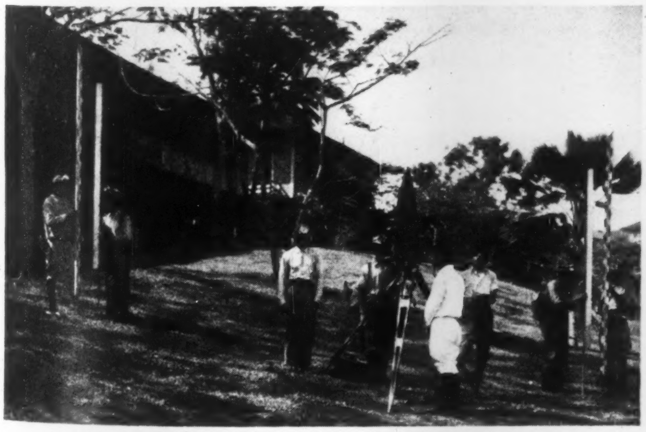
As the lake filled, large numbers of the main-line benches were covered and many of the higher ones were isolated on unoccupied islands. To check the few remaining benches and to establish new ones, another trans-Isthmian precise-level line was run in 1924–1925. Although the results of this check did not agree exactly with the old work, the discrepancies were not sufficient to make it advisable to change the reported elevations of the bench marks.

In the several years since these bench marks were established it has been necessary to move a number of them. And a considerable amount of settlement has been found in all but the most carefully located temporary non-precise bench marks, especially in the filled ground near the terminals of the Canal.

With the start of surveys for the proposed enlargement of the Panama Canal, it will be necessary to establish permanent bench marks in new areas. In order to avoid any error in the new levels due to errors in, or settlement of, the old bench marks it was thought advisable to make another check of them.

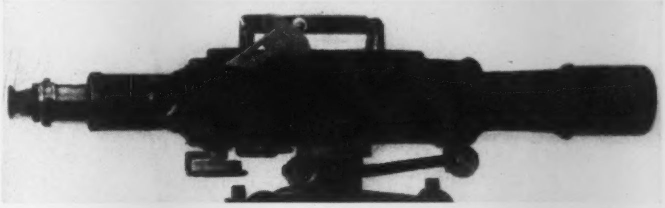
All previous precise level work in the Canal Zone has been done under very difficult conditions. The most important single difficulty is the excessive heat waves caused by local high temperatures and high humidity. Accurate sights of over 150 ft are not possible after 9:00 a.m., and the heat waves continue to limit the length of sight until late in the afternoon. An added difficulty, in the case of work done during the dry season, is that the average daytime wind (over the exposed parts of the line along Gatun Lake) is approximately 13 miles per hour.

In order to avoid such difficulties, it was decided to do the 1938 work at night. The experiment was highly successful: very uniform temperatures prevailed (75 per cent of the work being done at temperatures of between 20 and 25 C); there was no uncomfortable glare, and no heat waves; and the average wind near the exposed lake sections was cut to approximately 7 miles per hour.



PRECISE LEVEL PARTY EQUIPPED FOR NIGHT WORK

Work was started at the Atlantic end, and one main line was run along the line of the Panama Railroad, using bolts in the towers of the trans-Isthmian transmission line as bench marks. Such benches were established at approximately one-mile intervals. This main line included only those old permanent bench marks that were very near the railroad. Benches were also placed on the transmission-line towers that are opposite all old benches not near the railroad; side lines were then run to tie these to the main line.



PRECISE LEVEL EQUIPPED WITH LIGHT TO ILLUMINATE BUBBLES

The specifications of the U. S. Coast and Geodetic Survey for precise leveling were followed for all the work. The length of sight was limited to 300 ft, since all previous Isthmian levels had been run with that length as a maximum. However, with the night work this could have been lengthened to the permissible maximum of 450 ft. Several experimental circuits were run with this length of sight and they checked with the same accuracies as those run with the shorter sights.

The instrument used was a level of the type known as the Coast Survey precise level. The rods were of the latest standard specifications of the Coast and Geodetic Survey. They were equipped with the center invar strip graduated into centimeters. Most turns were made on the steel turning points with the hemispherical centers, on which the flat bottom of the rod was placed. The few exceptions to this were in Panama City, where it was necessary to use a small steel ball set in a hole chipped in the pavement.

The party consisted of one observer, one recorder, one instrument bearer, two rodmen, two battery and reflector carriers, and two helpers. With the exception of the observer and recorder, all were native workmen.

In order to work at night it was necessary to illuminate the main level bubble (which, on this type of instrument, is set inside the telescope) and the small circular level bubble which sits on a bracket near the center of the level. Both bubbles were lighted by one 3 to 6-v flashlight bulb supported on a bracket. The latter, in turn, was attached to the level by one of the screws that fasten the supports for the reflecting mirror above the main level bubble. The bracket and bulb socket were made from the parts of an ordinary hand flashlight.

Current for this light was supplied by two dry cells, connected in series and clamped to the legs of the tripod. One connection from the light was grounded to the level, while the other was carried to the battery through a tumble switch, attached to the leg of the tripod. The other connection from the battery was also grounded to the level. This light was turned off when moving the level. The battery was renewed after approximately two months of work.

ROD AND REFLECTOR IN POSITION FOR OBSERVATION

It was not necessary to make any provision for illuminating the cross hairs in the level, as there was sufficient contrast between the white parts of the rod and the cross hairs to make reading easy.

REFLECTORS FOR ILLUMINATING THE RODS

Each rod was lighted by bulbs placed in a rectangular reflector that extended from 2.5 to 10.0 ft from the ground. These reflectors were made from $^1/_{16}$-in. stainless steel, bent into a rectangular trough 3 in. deep and $2^1/_2$ in. wide, and mounted on a narrow board. The bulbs were 6-v auto taillights and were placed approximately 2.5 ft apart—four bulbs to each reflector. In operation, this reflector was placed in front of the rod and slightly to one side; thus the light would shine directly on the face of the rod and be reflected back to the instrument at the sharpest angle possible. A distance of one foot between rod and reflector gave the most even illumination of the rod. If held nearer, the darker spaces between the bulbs could not be read, while if held too far from the face, the entire rod would be too dark for easy reading.

The lights in each reflector were connected in parallel and were supplied with current by 12 dry cells, connected in 3 parallel sets of 4 in series. These batteries were placed in boxes which in turn were mounted on pack boards. The two batteries and reflectors were carried by two extra native helpers that accompanied the rodmen at all times. The connection from the reflector lights to the battery was taken through a tumble switch fastened to the side of the reflector, and the lights were kept turned off at all times unless signaled on by the observer. Batteries were changed at the end of every sixth night's work—before they began to lose their maximum lighting power—to avoid any risk of losing a large part of a night's work due to dim lights.

Every member of the party was furnished a 5-cell head lamp, for notekeeping and walking. The observer used a 3-cell hand lamp, as a head lamp interfered with efficient use of the level.

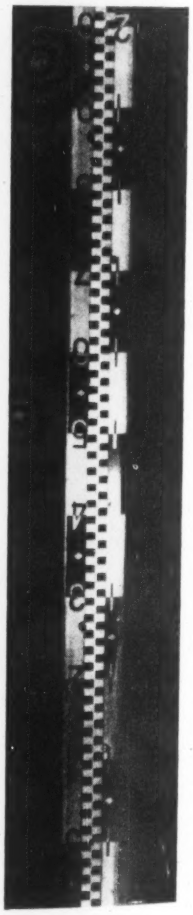
On several nights during the earlier part of the work, temperature and humidity conditions were such that moisture collected on the glass parts of the level, making work difficult. A broadcloth hood (shown in an accompanying photograph) was therefore made, which covered the prism tube, the reflecting mirror, the glass cover for the main level bubble, the circular bubble with its reflecting mirror, and the light. This hood was provided with holes for the two eyepieces, both holes being fitted with draw strings to make them snug. The string around the telescope fitted on the main housing—back of the bubble recess at the top and in front of the micrometer screw at the bottom. The hood was fastened in front by two open-end draw strings, one of them passing around the main housing just back of the slow-motion screw, and the other passing around the lower part of the main housing above the spindle clamping screw. A round glass window was placed in the hood to make the circular bubble visible.

This hood prevented any further delay due to condensation of moisture; it also made it possible to run through light rains that would otherwise have stopped the leveling, since the spray was prevented from reaching the glass parts of the level. Although the nights on which condensation occurred were few, the hood was used continuously during the latter part of the work; it was the most effective means of preventing the reflections from the instrument light from disturbing the observer.

SPEED OF LEVELING

Although the progress over individual days and hours was good, reruns and returns to run side circuits (on which a large part of the time was used in walking) brought the average production down. Much better average progress would have been obtained if better transportation facilities could have been arranged. The slowest observed rate of leveling was approximately one-half mile per hour, while the best observed rate was one mile per hour.

The average rate of completed leveling for the entire work was 2.78 km of single-run line per working day



PORTION OF THE ILLUMINATED ROD AS IT APPEARED TO THE OBSERVER

Dark Spot on Rod near 1.1-Meter Mark Is a Worn Place on the Frame. Dark Sections Due to Uneven Illumination May Be Noted on Center Invar Strip at 1.2 and 1.8 Meters charged against the field work. This amounts to an average of 5.56 km of single-run line for each night of 12 working hours, or 0.46 km of single-run line per hour. If allowance is made for the lines re-run, this rate of leveling becomes 0.67 km per hour. The speeds of the previous precise leveling on the Isthmus in single-run line per hour, are as follows: 1908 levels, 0.29 km; 1924–1925 levels, 0.35 km; on other lines run under more difficult conditions, such as on highway grades, 0.22 and 0.20 km. These speeds were computed by the same method as was the 0.46 km per hour, that is, by dividing the total length of completed line by the approximate number of hours spent on the work.

ACCURACY OF THE WORK

In the completed work there were 78 circuits, with a total length of 100.81 km (84.84 km on the main line and 15.97 km on side ties). Thirty-one of these circuits, with a length of 45.22 km, had to be re-run—16 because they were "blundered" in some manner or other, and 15 because, though not blundered, they did not close within the limit of error of 4 mm times the square root of the length of the circuit in kilometers. (A line was considered blundered if, for any reason, it did not close within one centimeter. Most of the blunders were of 0.5 m or more.) Thus, in all, 109 circuits were run. The percentage of these 109 circuits closing with a difference between fore and back runs of less than the amounts shown below, was:

1 mm times the square root of the circuit in kilometers. . . .18
2 mm times the square root of the circuit in kilometers. . . .40
3 mm times the square root of the circuit in kilometers. . . .56
4 mm times the square root of the circuit in kilometers. . . .72

The maximum length of circuit was 3.80 km, and the average length was 1.38 km. The average closure for the accepted circuits was 1.85 mm per circuit, and the average value of the closure error divided by the square root of the length of the circuit in kilometers was 1.59 mm. The maximum difference between fore and back runs was 5 mm on the accepted circuits.

In Fig. 1(*a*) are shown the differences between the forward and backward runs, accumulated algebraically. Figure 1(*b*) shows the value of the probable error, *R*, and Fig. 1(*c*) shows successive values of the ratio of the probable error to the square root of the distance in kilometers. This last value compares favorably with the similar ratio found from other local leveling, the final value being 0.71. The ratio values for the 1908 levels, as run by two parties, were 0.66 and 0.45; that for the 1924–1925 levels, 0.85. The like ratio values for other local precise-level work have been higher.

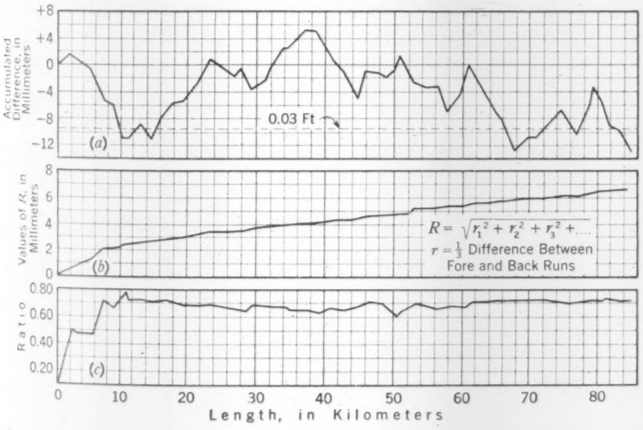
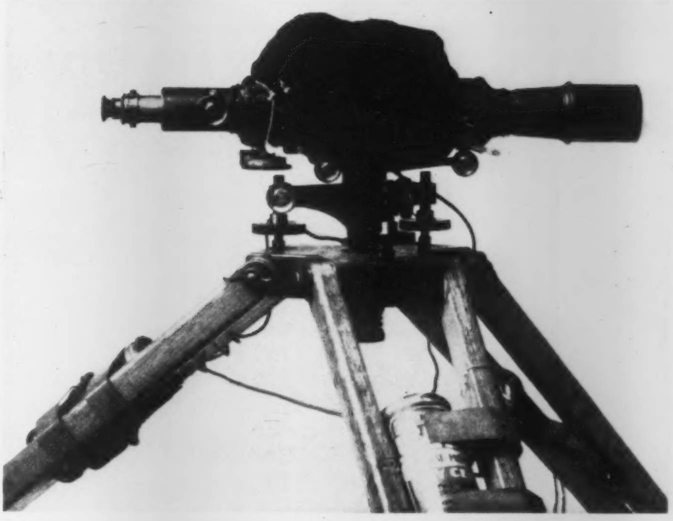


Fig. 1. Successive Values of Errors in 1938 Precise Level Check

(*a*) Difference Between Forward and Backward Runs Accumulated Algebraically; (*b*) Successive Values of Probable Error, *R*; (*c*) Ratio of Probable Error to Square Root of Length in Kilometers



The Level, Showing Dry Cells, Wiring, and Hood

Differences in elevation between the bench marks, as found by the instant line of levels, agree very well with the differences found by the other two runs. The elevations computed from these differences, using a bench on the Atlantic side as a base, check several bench elevations on the Pacific side. The discrepancies between the 1909 and 1938 lines of levels vary from 0.015 to 0.060 ft.

While the methods described in this article were partially of an experimental nature, the object of the work was to run an actual line of levels. The total extent of the work was not sufficient to justify making the changes in equipment that were found advisable during its performance. On any future work done at night, the instrumental lighting and hood arrangement would be much the same as described. However, a more satisfactory method of lighting the rods would be to use small elongated bulbs in individual, polished, semicylindrical reflectors, fastened by brackets to the side of the rod. These lights would be placed at proper intervals to light the rod evenly for its entire length. In this way the regular rodman would handle the rod, the lights, and the battery, eliminating the extra reflector carriers.

In drawing any conclusions from the work reported here, it is to be remembered that the work was done in the tropics, by relatively inexperienced levelmen, aided by native helpers. Under the given conditions, both speed and accuracy were higher than could have been obtained by the same party working in the daytime.

The value of doing precise level work at night in other localities would depend on the amount of interference from daytime heat waves. In places where the length of sight is limited by such waves, faster leveling can be done at night with little extra expense. In places where the length of sight is limited by other conditions, no material advantage is obtained by night work.

The work described here was done by the author for the Section of Surveys of the Panama Canal. R. Z. Kirkpatrick is chief of surveys, and the Section of Surveys is in the Department of Operation and Maintenance of the Panama Canal, under the administrative charge of Lt. Col. W. D. Styer, assistant engineer of maintenance. Col. Glen E. Edgerton, U.S.A., M. Am. Soc. C.E., is engineer of maintenance of the Panama Canal, and Brig. Gen. Clarence S. Ridley, U.S.A., is governor of the Panama Canal.

Basic Factors in the Plight of the Railroads

Decentralization of Industry Seen as Major Cause of Declining Freight Traffic, Though Competition, Too, Is Having Its Effect; a Partial Solution Offered

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It is easy to blame the decrease in rail freight traffic on the depression, or on competition. But Mr. Truesdell here points out that such traffic was on the decline for at least eight years before the depression—and obviously for some time before motor transport was a highly competitive factor. He suggests that the actual cause is decentralization of industry, and that the effects of that phenomenon on transportation may well be permanent. Coordination and consolidation of transportation facilities, including motor transport, he says, offer a partial solution of the difficulties which the railroads are facing today.

IN 1937, with industrial production at a level about 92 per cent of that in 1929, railway revenues were only 67 per cent of 1929. This has been explained variously as due to unrestrained truck and waterway competition, pipe-line traffic, lack of durable goods to be moved, and so forth. It is, however, probably due in large part to other more fundamental causes.

While the texture of transportation has changed, with motor transportation slightly greater than in 1929, and some present shortage of durable goods movement, there is on the whole much less transportation of all kinds now, per unit of industrial production or per unit of national income, than in 1929. For example, the transportation income from all sources in 1929 was estimated by the Bureau of Economic Research of the Department of Commerce at $6,847,000,000 (of which $1,194,000,000 was from motor transport). In that year the index of industrial production was 119. In 1936 the industrial index was 105, which would indicate that transportation revenue should have been $6,030,000,000; yet it was actually only $5,129,000,000 (of which $1,274,000,000 was earned by motor transport). This is only 85 per cent of its 1929 ratio to industrial production.

In fact, there has been a steady decrease in relative railway revenues and freight, at least since 1920–1921, as shown in Table I. Certain factors would seem to indicate that this relative loss of traffic is a result of major economic changes which have taken place in industry rather than of competition from other forms of transportation, and that it is likely to be permanent. If so, the railroad rate structure, set up under a system of constantly increasing traffic, will need revision to conform with changed conditions, and to permit railway lines to earn sufficient revenue on a lower volume of traffic.

Under the existing competitive system, the price of transportation is continually subject to attack, and for various reasons it is peculiarly vulnerable to such attack from industrial interests. Alined in opposition to the traffic departments of some 250 major transportation companies of the country are 175,000 manufacturing plants employing traffic representatives, as well as innumerable organized commercial and trade groups, all working to secure lower transportation costs. These industrial and trade groups know exactly how the level of freight rates will affect the sale and distribution of their products, but the transportation companies have only a limited knowledge of the effect of decreased rates on rail revenues. Because of this pressure from all directions, the rail lines find great difficulty in resisting the continuous reduction of freight rates, especially as a powerful competitive factor—motor transportation—has entered the field with rates made on an entirely different basis.

Practically all the regulatory bodies have been instructed by law to see that rates charged for transportation are fair and equitable to the parties concerned. Too many of these authorities, with little more than a legal knowledge of the issues involved, have been forced to the industrial side by the weight of the evidence presented and have failed to thoroughly investigate the sufficiency of rates on their own account. In the main, they have served merely as arbiters between the contesting parties, and in the absence of sufficient evidence to guide them, their decisions have almost uniformly been in the direction of a downward revision of rates. Many of these decisions should have been matters of compromise—the railroads presenting counter demands that other rates be increased proportionately—and not a few should have been carried to the courts as confiscatory. Some more effective system of establishing and maintaining proper rates is necessary. The natural outcome of the present methods of rate making is a continual lowering of the relative rates on manufactured products while the great extractive industries of agriculture, mining, and forestry foot the bill.

Like most manufacturing enterprises, transportation is subject to the law of decreasing cost with increasing volume. Since maintenance, traffic, general, and capital expenses were unaffected by ordinary fluctuations in traffic, each additional passenger or ton of freight reduced the fixed-cost burden per unit of all traffic and was profitable to the extent that it paid something more than direct costs. In making rates, this decreasing cost theory has been frequently employed, and the shipper has been given the benefit of something less than total cost. There is nothing unreasonable in the theory

TABLE I. SHOWING THE DECREASE IN RELATIVE RAILWAY REVENUES AND FREIGHT SINCE 1920–1921

			CLASS 1 RAILWAYS		PER PRODUCTION INDEX UNIT		PER MILLION DOLLARS OF NATIONAL INCOME	
YEAR	FEDERAL RESERVE INDEX OF PRODUCTION	NATIONAL INCOME IN MILLIONS OF DOLLARS	Gross Revenue in Millions of Dollars	Tons Carried, in Millions	Rail Revenue, in Millions of Dollars	Rail Tons, in Millions	Rail Revenue, in Thousands of Dollars	Rail Tons, in Thousands
1920	87	74,300	6,178.1	2,260.0	71.0	26.0	83.2	30.4
1921	67	55,597	5,516.6	1,690.8	82.5	25.2	99.0	30.4
1923–25	100	73,213	6,111.2	2,269.9	61.1	22.7	83.5	31.0
1929	119	81,034	6,279.5	2,451.6	52.7	20.6	77.5	30.3
1932	64	39,545	3,126.8	1,168.3	48.9	18.2	79.0	29.5
1935	90	52,959	3,451.9	1,427.0	38.3	15.9	65.2	27.0
1936	105	60,816	4,052.7	1,713.0	38.6	16.3	66.8	28.1
1937	109	69,000	4,166.0	1,821.1	38.3	16.7	60.4	26.4

outside of its discriminatory character, and it is entirely successful as long as traffic is increasing.

This "added cost" or "out-of-pocket expense" theory of rate making has long been justified by economists as a proper basis for making rates. The much-quoted oyster case of Hadley (used by Acworth in his *Elements of Railway Economics*) illustrates a rate made on the principle of "what the traffic would bear," but it also illustrates the added-cost theory of rates. Unless the rate on oysters was low enough to permit the oystermen to sell in the market with a margin of profit, no oysters would move from point *X*. The rate from *X* of $1 would only move half a car, which would not pay direct cost; but by making a rate of 75 cents from *Y*, beyond *X*, the car would be filled and the direct costsof the added car would be earned. Despite the approval of many authorities, no one major economic theory has been more disastrous to railway revenues. Through regulation and competition the high rate from *X* either has been reduced to its proportionate part of the insufficient rate from *Y*, or the traffic to which the oysters from *Y* were added at part cost has disappeared.

If sources, demand, and markets could have been maintained along with a monopoly in transportation, the damage would not have been so serious. But although the railways could control their own economies of operation, the products they handled were beyond their control. Economies of manufacturing, consisting of improved location of plants with regard to raw materials, labor, and so forth, were continually working to the railways' disadvantage. In addition, the monopoly of the railroads in the field of transportation has gradually been broken down by other means of transportation—such as pipe lines and motor trucks.

EFFECTS BEGAN TO BE FELT IN EARLY 1920's

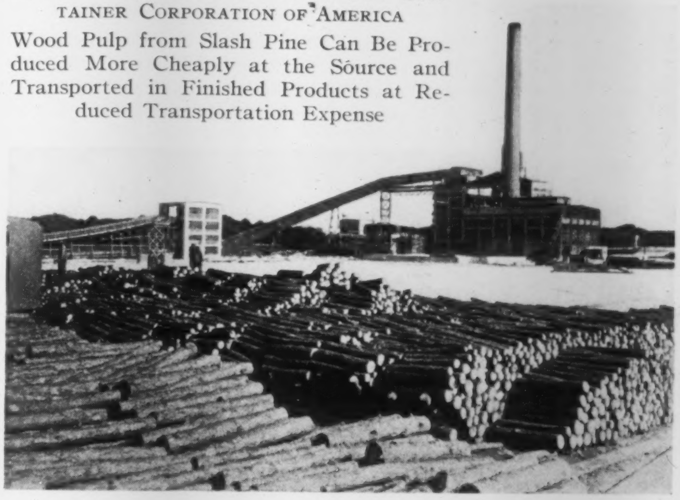
What is the result? Since 1921 and up to 1935, rail rates decreased 22 per cent for the country as a whole—27 per cent in the West, 21 per cent in the South, and 18 per cent in the East. Under normal circumstances it would be expected that these reductions were due to increased traffic density. But that was not the case. In 1921—a depression year—the density was 1,308,938 revenue ton miles per mile of road; in 1935 it was 1,185,368, a decrease of 9.3 per cent. Return on investment was 2.92 per cent in 1921 and 1.93 per cent in 1935. Even this return would not have been possible without heroic economies in operation, many of them seriously affecting the future efficiency of the rail system.

The advocates of motor transport have nowhere contended that it can compete with the railroads in the bulk haul of solid freight at average rates, and probably it could not even if the rates were 50 to 100 per cent higher than they are. For instance, no motor transport system could ever compete with the soft coal carriers, which are also an excellent example of the theory of decreasing costs. These carriers have a traffic density of from 4 to 5 million revenue ton miles per mile of line per annum and earn large profits at a rate per ton mile of 3 to 6 mills, or about half the revenue needed by rail lines elsewhere. However, motor transport can haul the high-rated traffic, which has carried the burden of fixed expense for the railroads, at a rate not cheaper than rail cost but cheaper than the price charged under the present system of rates.

These various factors have been whittling away at rail traffic for years, but it was not until the end of westward expansion and of the artificial stimulation of the World War and reconstruction period that the effect began to appear. The relatively high rates on raw products moved during the development period in the West and South were maintained beyond the development period by war needs; but competition and the low price of farm products at last have had their effect on traffic, and the movement of industry has accomplished the remainder.

TYPICAL OF INDUSTRY'S DECENTRALIZATION IS THE FERNANDINA PLANT OF THE CONTAINER CORPORATION OF AMERICA

Wood Pulp from Slash Pine Can Be Produced More Cheaply at the Source and Transported in Finished Products at Reduced Transportation Expense



In these territories the later traffic was in manufactured products; and in many cases it was taken at "added cost" at rates relatively lower than those on raw materials—or at least at rates that were a smaller percentage of the product value, and thus a constant inducement to industries to move nearer the source of raw materials and thereby effect marked savings in cost of their products.

To illustrate these relatively high rates on raw materials: The rate on corn from Omaha to Chicago is 15 cents per 100 lb, while the rate on 20 lb of live hog which can be produced by 100 lb of corn is 8 cents for the same haul, and the rate on 14 lb of meat products is only 3.5 cents. This shows the tremendous advantage of moving the packing plant and the hog farm to the corn fields of the Middle West. Other typical examples adapted from the Freight Traffic Report of the Federal Coordinator are shown in Table II.

TABLE II. FREIGHT RATES THAT ILLUSTRATE THE ADVANTAGE, TO INDUSTRY, OF FACTORIES AND PLANTS NEAR THE SOURCE OF RAW MATERIALS

COMMODITY	FREIGHT RATE PER TON	RELATIVE AMOUNT MOVED	RELATIVE VALUE PER TON	RELATIVE % OF VALUE	RATE FOR EQUIVALENT AMOUNT
Coal	$1.11	1.8	$ 4.08	27	$2.00
Coke	1.73	1.0	18.20	10	1.73
Iron Ore	2.36	2.0	1.24	191	4.72
Steel	2.07	1.0	5.10	41	2.07
Timber, logs	1.65	6.0	3.04	54	9.90
Lumber	5.93	4.0	17.03	35	23.70
Furniture	18.14	1.0	238.19	8	18.14
Crude petroleum	3.23	2.2	5.98	54	7.10
Gasoline	5.27	1.0	26.84	20	5.27
Pulpwood	1.33	1.2	1.99	67	1.60
Newsprint paper	7.00	1.0	31.44	22	7.00
Wheat	3.34	1.4	21.57	16	4.68
Flour	3.91	1.0	53.84	7	3.91

Note: Relative amount moved indicates the amount in tons of raw material which will produce 1 ton of the finished product just below, and the rates in the last column are for these equivalent amounts.

The movement of industry has consisted usually in constructing branch factories near raw materials, equipping these branch plants with the latest machinery for efficient low-cost operation, and making them large enough to supply the adjacent territory, thus shortening hauls. During the depression, starting in 1929, the lowest manufacturing costs became imperative and these branch factories were speeded up and the older, high-cost factories were closed. Usually the smaller amount of labor needed was more cheaply available in the locality of the branch plant, an added advantage. As already indicated, these branch plants were generally located nearer to markets as well as nearer to raw materials, thus saving the cross haul of products as well as materials, at the expense of railway revenues.

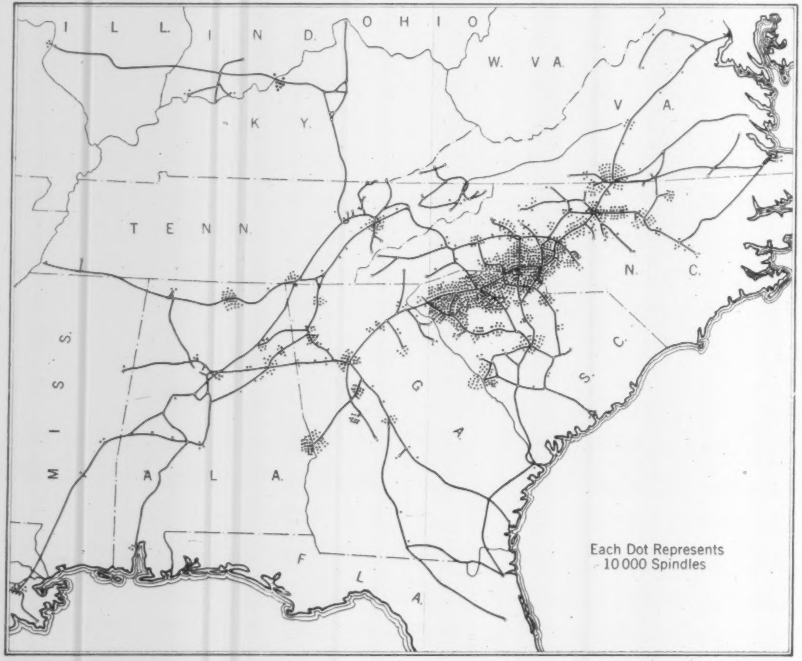
Railway managements have considered this movement of industry an advantage and have aided it in every way, but it has not worked out very successfully. It was hoped to build up additional freight and passenger traffic from the increase in industrial development, forgetting that the communities concerned would never require as much goods as the purely industrial communities of the East. The amount of employment was less, the wages paid were less, and each community in large part was self-supporting as regards food products. The resulting loss in freight traffic was in no way offset by higher rates on the finished products.

In the West and South the population is now largely stabilized, and the available resources are being utilized. There remains no undeveloped land beyond these areas capable of supporting further settlement, except the Pacific Coast—and the Panama Canal has seriously reduced the profitability of traffic to that territory. Thus, what was once a fairly heavy traffic in raw materials moving to eastern manufacturing centers and back as finished products for use in territorial expansion, has now become a short-haul light traffic of finished products moving in one direction only. Much of the distribution of finished goods, as well as the collection of raw materials in these new localities, is carried out independently of the railroads.

OUTSTANDING EXAMPLES OF DECENTRALIZATION

After the Civil War, and until 1880, grain moved to Buffalo, Rochester, New York, and Baltimore for milling, and part of the product went back to the grain fields as flour and feed. In 1890, Minneapolis, Duluth, Milwaukee, and Chicago were the principal milling centers for grain, and there was still a heavy two-way movement of grain and products over the western trunk lines. Today the major part of the milling, except for grain moved at low rates over the Great Lakes to Buffalo, is done at Minneapolis, Cedar Rapids, Omaha, Kansas City, and Wichita, in the middle of the grain territory. Only the flour produced in excess of local consumption moves by rail; and the feed is distributed and consumed locally.

Similarly, in an earlier day, baled cotton moved from the South to New England to be made into cloth for use again through the South. Later, cotton goods manufacture increased in the South, as a result of labor conditions and improved machinery—until in 1926 there were twice as many spindles in the country as were needed. The depression practically killed the cotton goods industry in New England, and the movement of cotton north and cloth south has resolved itself into a movement of finished or partly processed goods, much of which moves by truck for speed.



TEXTILE SPINDLES IN TERRITORY SERVED BY SOUTHERN RAILWAY SYSTEM
Cotton Textile Production Has Doubled in the South Since 1920; Concurrently, Raw Cotton Moved by Rail Has Decreased 25 Per Cent

The silk industry in Paterson, N.J., is now seriously threatened by rayon goods produced in Tennessee and Virginia, close to the timber used as raw material, and within easier reach of all markets. Once corn moved from Iowa and Nebraska to fatten hogs in Ohio, Indiana, and Kentucky, which were slaughtered in Cincinnati. Later the corn was brought to Illinois and Indiana for hogs slaughtered in Chicago. Now Chicago has passed its peak in the slaughter of hogs and cattle, and is being replaced by the Missouri River cities where the corn can be fed to the hogs on the farm and the hogs marketed by truck. This has effected a temporary economic gain to the consumer, caused by the inequity of the rate structure. But if the result is permanently impoverished railways, higher rates on the remaining agricultural traffic, and perhaps more tenant farmers, it is difficult to see any permanent gain.

Another instance of such a shift is the sugar beet industry, which has moved westward as a result of changes in rail rates and sugar tariffs. The paper industry of Wisconsin and Michigan is now experiencing increased difficulty owing to the competition of paper plants close to unlimited forest resources in the South and on the Pacific Coast, and has resorted to importations of wood pulp from Canada and Sweden to piece out its failing local supply of pulpwood. The furniture industry is moving from Grand Rapids and Chicago to the Southern Appalachians, where better hardwood lumber can be secured with less transportation cost. Lynn, Brockton, and Haverhill, Mass., are still leading shoe manufacturing centers, but their output is largely for export. Shoes for domestic consumption are increasingly being manufactured in Auburn, N.Y., Chicago, St. Louis, and Kansas City. Milwaukee and other Wisconsin cities in the center of the domestic leather tanning territory are likely to take a greater part in shoe manufacture in the future.

Iron and steel plants have moved to points where the lowest combined cost of transportation for ore, coal, and steel products obtains, and although the "Pittsburgh plus" is abolished, differential prices are maintained at the various plants representing the increased cost due to freight from Pittsburgh which are paid by the consumer but do not accrue to rail revenues. Automobile manufacturers, finding their products under a heavy burden of freight rates, deliver by road until the volume justifies a branch assembly plant, to

Power from the Great Hydroelectric Projects of the Northwest Will Ultimately Make Unnecessary the Transportation of Approximately 7,000,000 Tons of Coal Annually

These Projects Will Also Further the Decentralization of Industry and Reduce the Transportation of Finished Products from the Eastern States

which parts can be transported at lower relative cost. General Motors Corporation has such plants in Tarrytown, N.Y., Cincinnati, Ohio, Atlanta, Ga., Janesville, Wis., St. Louis, Mo., and San Francisco, Calif. The rail movement of parts to these points weighs as much as the automobiles, but produces less rail revenue.

Wherever the volume of construction is sufficient, local clay and limestone quarries are opened to make brick, tile, lime, and cement. Concrete piles, pipe, slabs, and tile are now mainly manufactured on the construction job without any transportation whatsoever. The manufacture of agricultural implements has moved from Auburn, N.Y., by way of Columbus and Springfield, Ohio, to Chicago, Racine, Peoria, Streator, and Moline, closer to the farms that use the equipment. The production of machine tools still centers chiefly in New England but also follows each industry that is supplied; and Cleveland, Detroit, Chicago, Milwaukee, and St. Louis have become increasingly important, with the result that the haul on high-quality freight is shortened.

The refining of petroleum has expanded from Pennsylvania and Ohio to Illinois, Kansas, Oklahoma, Texas, Wyoming, and California. Crude oil still moves in bulk to the older refining centers but principally by pipe line at one-third the rail rate. The spread of gas and electricity for power has retarded the progressive development of coal except in volume where it can be moved at low cost. Cigar and cigarette manufacture has moved progressively from New England—through New York, Baltimore, and Richmond—to the North Carolina cities at Winston-Salem, Durham, and Reidsville in the center of the tobacco growing region. Other less-notable movements of industry could be cited, but the effect has always been the same. Had territorial expansion kept pace with industrial movement, extension of the railroads into new areas would have added new fields and new resources more than sufficient to offset these losses. When the limit of expansion was reached, all the railroads suffered, but the more recently constructed lines, with their smaller reserves of capital, were the hardest hit.

Reorganization is now necessary for many of the railroads of the South and West. But the remedy will be temporary only unless changed conditions are recognized. The impossibility of further traffic expansion must be taken into account—either by revision of rates or by widespread abandonment of unproductive lines.

Rates can be revised to yield better revenues without making them vulnerable to competition from motor transport, but the change would be too radical to be expected of the present politically constituted regulating bodies, and certain rate-subsidized industrial developments would suffer greatly. It is probable that the future holds only repeated reorganizations with gradual abandonment, until such time as the lighter traffic will support the lines remaining. When that time comes, the high-class merchandise freight will be monopolized by motor transport in the hands of a few large companies reaching all important points in the United States with fast daily service. The shipper will favor such a development because it will reduce his carrier transactions and release valuable space now used for shipping.

A PARTIAL SOLUTION TO THE RAIL PROBLEM

Coordination and consolidation of transportation, if accomplished, offer a partial solution to the rail problem. With the great decrease in traffic and the use of improved transportation machinery, labor must expect to absorb some of the effects of changed transportation conditions. When a powerful competitive type of transportation, such as the truck, enters the field, with employees who will work with enthusiasm and energy at lower rates of pay, there must be some concessions from the labor employed by the older modes of transportation if they are to remain in business. Otherwise these older forms of transportation will be destroyed piecemeal by high costs, regardless of the economic facts or the needs of the community. In many cases the replacement of unprofitable branch lines with truck lines will increase transportation costs for the heavier bulk commodities.

However, as things now stand the Interstate Commerce Commission has interpreted the Motor Carrier Act of 1935 so rigidly as to prevent complete coordinate use of highway vehicles by the rail carriers. Undoubtedly this is a case of a "new broom," and represents an effort to preserve competition which is in many cases wasteful and costly. Certainly if we are to have consolidation of parallel rail activities for economy, there should be nothing to prevent consolidation of parallel truck and rail-truck activities for economy. Truck routes as now set up do not follow rail lines exactly. To deny a railroad-acquired truck line the right to serve an off-rail point on its route is to increase the cost of transportation service to that point and create an unnatural and wasteful competition of cross routes. Rail lines must be permitted to acquire and use truck and bus service with a minimum of restrictive limitations. In saying this, I have in mind the fact that the railroads are the established transportation medium which has developed present trade routes and methods, and should therefore be best able to coordinate transportation with the most economy and greatest benefit to the shipping public.

On the other hand, consolidation of truck lines, while it will decrease competition in truck service, will not reduce the cost of truck transportation appreciably, since truck costs are largely proportional to the units in use. Such consolidations will, however, permit motor transport to make further inroads into the higher-rated rail traffic.

The apparent fears of Congress and the Commission that rail-dominated truck service would be injurious to highway transport ignores the fact that further certificates can be issued upon proof of necessity, and that there are a great number of railroad transportation men who are sincere in their desire to use highway vehicles for economy of service. If these men are somewhat slow to admit the advantages of highway transportation in speed and flexibility for certain traffic, is not this entirely understandable? Having spent years in building up what was and is the most efficient rail transportation system in the world, they naturally hate to see it threatened in any way by a newer means of transport.

Ley Creek Sewage Treatment Works

Activated Sludge Plant Near Syracuse, N.Y., Embodies Several Unusual Features

By Glenn D. Holmes
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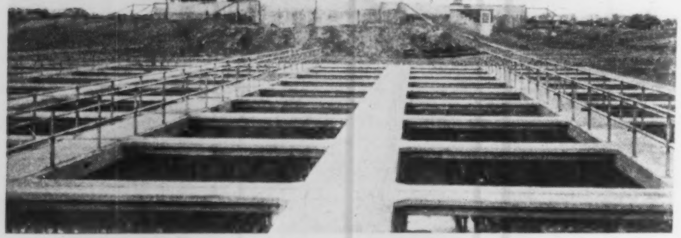
Director–Chief Engineer, Onondaga Public Works Commission, Syracuse, N.Y.

The 4.5-mgd plant of the Ley Creek Sanitary District is of interest both from the standpoint of sanitary engineering design and because of the difficulties encountered in construction. Duplicate treatment units and piping permit unusual flexibility of operation; the effluent filter is perhaps unique in design; the sludge-digestion tanks can function in either single or multiple stage; and the gas holder well serves as a settling tank for the supernatant. High ground-water level and the presence of quicksand caused trouble in construction, and a permanent caisson 40 ft deep had to be installed to provide drainage and prevent flotation of empty tanks. This article is abridged from a paper presented before the Sanitary Engineering Division at the 1938 Fall Meeting of the Society in Rochester.

Completion of the activated-sludge treatment plant on Ley Creek, near Syracuse, N.Y., is scheduled for early in 1939. The new facilities will permit the abandonment of six small and heavily overloaded plants and will provide treatment for the sewage of a population of 18,000.

The area to be served is shown in Fig. 1. It includes a small section of the city of Syracuse, all of the village of East Syracuse, several unincorporated communities, and a considerable area of undeveloped territory. In addition, application has recently been made to the Public Works Administration for another project covering the adjoining area along Bear Trap Creek, including the village of North Syracuse—the sewage from this district also to be treated at the Ley Creek plant.

The Ley Creek project includes about $5^1/_2$ miles of trunk sewer and $3^1/_2$ miles of laterals, but the present article is limited to a description of the treatment plant itself. The site of this installation, it will be noted from Fig. 1, is about three-quarters of a mile from the outlet of Ley Creek into Onondaga Lake, and the effluent is to discharge into the creek at the plant site.



Activating Tanks of Ley Creek Plant, with Sludge Digestion Tanks and Gas Holder in Background

It is natural to inquire why so high a type of treatment as activated sludge was selected, and why the plant was located so far from Onondaga Lake. The answer to the second question is that there are no suitable foundations along the lake front on which to construct a plant, nor are there suitable foundations to support a sewer between the site selected and the lake. Bridge abutments near the lake, supported on piles 200 ft long, have settled more than 2 ft. The plant location being thus determined, the highest type of treatment is required to prevent objectionable conditions along the creek, because of the small volume of flow available for dilution of the effluent. The cost of special foundations for a sewer and plant at the lake front would more than counterbalance any saving in cost that might be realized by constructing a less efficient plant in that location.

The treatment plant (Fig. 2) has been designed for a population of 30,000 and an average sewage flow of 4.5 mgd. The pumping equipment, grit chambers, and primary tanks will accommodate flows of 10 mgd. In the design, it has been the endeavor to provide for more than usual flexibility of operation by duplication of the treatment units, equipment, and piping connections, keeping in mind particularly the convenience of the operating personnel.

The pumping station is shown in section in Fig. 3. Sewage on entering the building will pass through a mechanically cleaned bar screen, or may be by-passed through a hand-raked screen; the screenings will be pulverized by a grinder and returned to the sewage; pumps will lift the sewage about 12 ft and discharge at the entrance of a two-compartment grit chamber, the velocity through which will be maintained at about 1 ft per sec by a venturi flume (Fig. 4).

After passing the flume the sewage may enter a preaeration tank, of 15-min detention, intended primarily for grease separation, or may pass directly to the four longi-

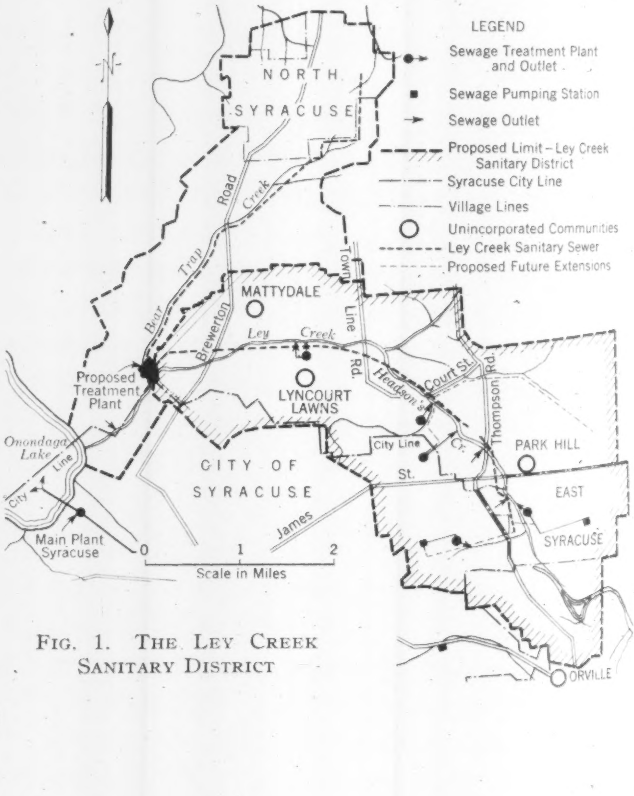

N
LEGEND
Sewage Treatment Plant and Outlet
Sewage Pumping Station
Sewage Outlet
Proposed Limit – Ley Creek Sanitary District
Syracuse City Line
Village Lines
Unincorporated Communities
Ley Creek Sanitary Sewer
Proposed Future Extensions
NORTH SYRACUSE
Road
Creek
Trap
Bear
Town
Line
Rd.
MATTYDALE
Brewerton
Ley Creek
Proposed Treatment Plant
Headson's
Court St.
Thompson Rd.
LYNCOURT LAWNS
Onondaga Lake
City Line
City Line
Cr.
PARK HILL
CITY OF SYRACUSE
St.
EAST SYRACUSE
James
Main Plant Syracuse
0
1
2
Scale in Miles
ORVILLE

Fig. 1. The Ley Creek Sanitary District

tudinal-flow primary settling tanks providing 2-hr detention. The entrance to these tanks (Fig. 4) provides for definitely splitting the flow through the several tanks in any desired proportion and for the prevention of streaming or cross currents at the entrance. The tanks are equipped with flight conveyors for sludge collection. The sludge hopper of each primary tank is connected by a separate pipe with the positive-pressure sludge pumps in the pumping station. There are three of these pumps, interconnected so that any one of them can pump from any tank, or any two can be in service at the same time discharging the sludge to either of two conditioning tanks, within the pumping station, or to any one of the four digestion tanks, or directly to the drying beds.

Interior of Activating Tank, Showing Air Piping and Diffuser-Plant Holders

Scum and grease removed by the return-flight conveyors of the primary tanks will be collected in a trough discharging into a steel tank in the scum well, the contents of which will be removed by centrifugal pump to the conditioning tanks in the pumping station or to any one of the four sludge digestion tanks or to the sludge drying beds.

TANKS, FILTER, AND SLUDGE-DIGESTION EQUIPMENT

The primary tanks are equipped with cross, side, and end V-notch weirs providing a weir length of five times the tank width. They are readily adjustable for elevation and any weir can be raised sufficiently to prevent overflow.

The effluent from each primary tank will be metered as it passes to its companion aeration tank. The aeration tank, however, can be by-passed and the primary tank effluent sent either to the final settling tanks, to the magnetite filter, or to the outlet sewer.

There are four aeration tanks, which will provide 5-hr aeration. They are of the two-pass spiral-flow type, with a double row of diffuser plates on the first pass and a single row of plates on the return.

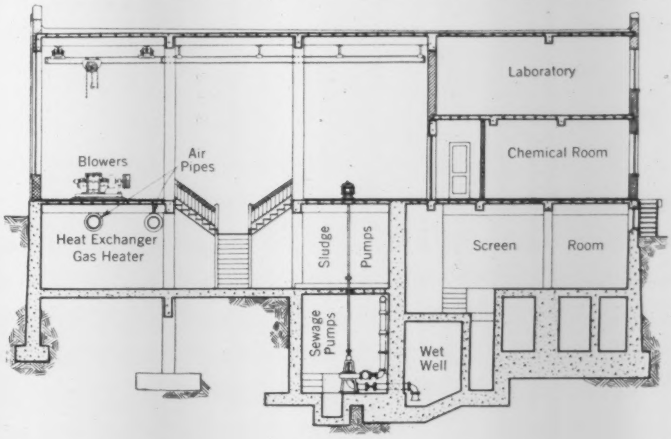

Laboratory
Chemical Room
Blowers
Air Pipes
Heat Exchanger Gas Heater
Sludge
Pumps
Screen
Room
Sewage Pumps
Wet Well

Fig. 3. Section Through Pumping Station

The final settling tanks are similar to the primary tanks, with the exception that the side weirs in the final stage extend three-fourths of the length of the tank. The effluent from the final tanks may be passed to the magnetite filter or discharged direct to Ley Creek.

The magnetite filter (Fig. 5) is of the circular downflow type. Our design of this unit, which differs from those heretofore constructed, includes an interior concentric cascade for the final effluent before it enters the outlet sewer. It is hoped that this final step in the treatment will insure an effluent of somewhat higher oxygen content.

Provision is made for pre- and post-chlorination of the sewage and for applying chlorine elsewhere in the treatment process.

Four circular separate sludge-digestion tanks providing 3.5 cu ft per capita are grouped around a central control building and may be operated in single or multiple stage. The warm overflow from the tanks, which may be taken from three different elevations, passes to the well of the gas holder, insuring above-freezing temperatures in the holder well. The gas-holder well also provides a long detention period for these overflow liquors and for the deposition of a large percentage of the solids before return to the incoming sewer.

Gas from sludge digestion will be utilized for operating an engine-driven blower supplying air for the activated sludge process. Heat recovered from the water jacket of the engine and from the exhaust will be used for maintaining optimum temperatures in the digesters. Two motor-driven blowers will also be installed.

Sludge from the digestion tanks may be drawn by gravity or pumped to the drying beds, two of which are open and one glass-enclosed. The drying beds are of the conventional type, with the exception that porous concrete tile has been placed for underdrains instead of open-jointed vitrified pipe, and concrete runways flush with

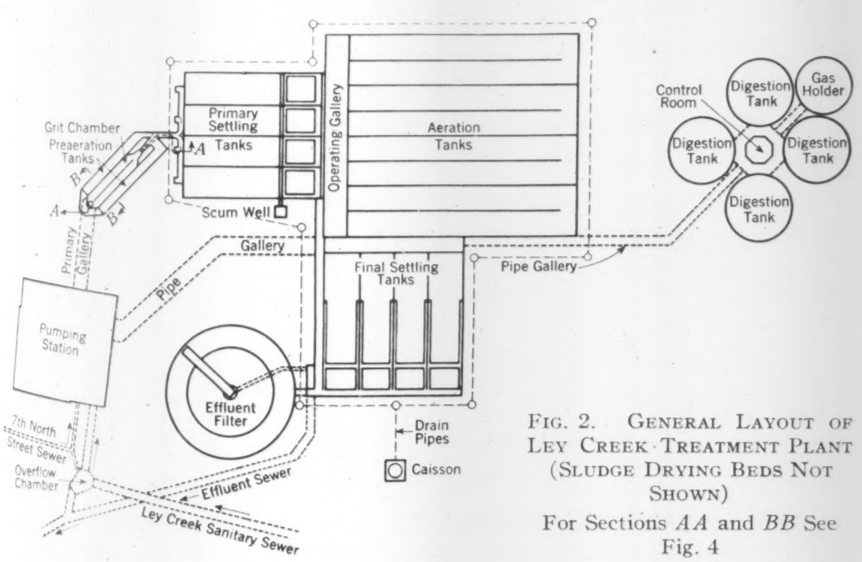

Grit Chamber
Preaeration Tanks
A
B
B
A
Primary Settling Tanks
Operating Gallery
Aeration Tanks
Scum Well
Gallery
Primary Gallery
Pipe
Pumping Station
Final Settling Tanks
Pipe Gallery
Control Room
Digestion Tank
Gas Holder
Digestion Tank
Digestion Tank
Digestion Tank
Effluent Filter
Drain Pipes
Caisson
7th North Street Sewer
Overflow Chamber
Effluent Sewer
Ley Creek Sanitary Sewer

Fig. 2. General Layout of Ley Creek Treatment Plant (Sludge Drying Beds Not Shown)

For Sections *AA* and *BB* See Fig. 4

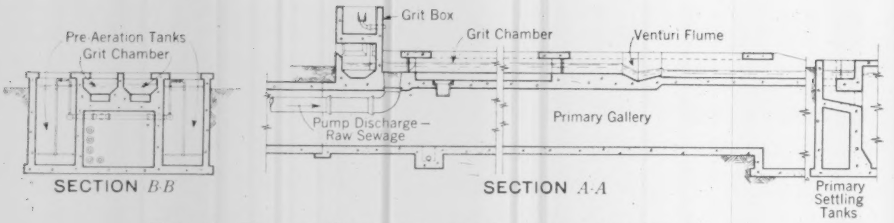


Fig. 4. Typical Sections; for Location See Fig. 2

the sand surface permit loading the dried sludge directly on trucks without auxiliary equipment.

Arrangement of the plant units and design of the structures has been influenced very largely by the subsurface conditions—high ground water and quicksand. The soil at the plant site for a depth of about 8 ft is an impervious blue clay; underneath this is a variable depth of quicksand which is superimposed on a rather fine, clean, water-bearing black sand. At the time ground was broken for construction, when the clay was penetrated, water gushed up and filled the test pits to within one foot of the surface. The preliminary borings, made by auger, had located the elevations of the clay, quicksand, and black sand correctly but had failed to indicate the high ground-water table.

The plant lies between Ley and Bear Trap creeks, both of which are within a few hundred feet of the site. Although the ground water was about 8 ft higher than the water in these streams, none of it was escaping to them but it was being carried underground toward Onondaga Lake. The surface clay blanket at the site dips below the stream beds, completely sealing off the underground flow.

CAISSON PROVIDED TO HANDLE GROUND-WATER FLOW

For the purpose of unwatering the site a concrete caisson, 10 ft in diameter, was sunk to a depth of 40 ft (Fig. 6). In order to prevent the entrance of sand during sinking, it was necessary to keep the caisson completely filled with water and to excavate by clamshell. The lower part of the caisson was then partially refilled with gravel, held down by a steel grating anchored in place.

Owing to the large volume of underground flow, it was not possible to lower the water sufficiently, by pumping from the caisson, to permit construction for the pumping station. Hence, after excavation for the tanks had been completed, well points were installed. Pumping has continued at a rate of about 2,000 gal per min for nearly two years.

Porous concrete drain pipes (Fig. 2) surrounding the tanks have been connected to the caisson, and the latter discharges by gravity to the outlet sewer. Thus the ground water now has a direct outlet to Ley Creek, and it will be safe during the greater part of the year to empty the primary, aeration, and final settling tanks for inspection or repair without danger of flotation. Inspection manholes on the porous drain pipe permit observation of the height of ground water at all times. If it is desired to unwater any of the tanks when ground water is high, a valve on the gravity outlet from the caisson may be closed and a permanently installed pump put in operation. This unwatering pump has a capacity of 1,500 gal per min against a head of 20 ft.

Because of the unfavorable underground conditions it was deemed expedient to place all exterior piping and conduits in pipe galleries. One gallery extends from the pumping stations to and across the entrance ends of the four primary tanks (Fig. 4). The grit chamber and venturi flume furnish the roof, and the preaeration tanks furnish the side walls for a large part of this gallery, in which are placed the raw sewage main, the sludge lines from each of the four primary tanks, the air piping to the preaeration tanks, and the electric conduits to the primary-tank mechanisms.

Another gallery extends to the control room of the digestion tank units with a side operating gallery between the primary and activating tanks. These galleries provide ample walkways for access to the plant units, particularly in inclement weather, and for the convenient adjustment of control valves. Seven entrances furnish safety exits as well as good ventilation.

Magnetite Filter with Cascade Aerator
Beyond This Unit Are Seen the Final Settling Tanks. Note the Well Points and Pump

ONE OF THE LARGEST WPA SEWAGE TREATMENT PROJECTS

The Ley Creek Sanitary District work is being done by work-relief labor, and is believed to be one of the largest sewage treatment projects undertaken by WPA. Similar projects are usually constructed by contract under PWA. The sponsor (Onondaga County) is furnishing the site, employs and pays for engineering and inspection, and furnishes small tools for construction and all the equipment installed for plant operation. All labor, material, and supplies for construction are furnished by the WPA, materials and supplies being to the specifications of the sponsor.

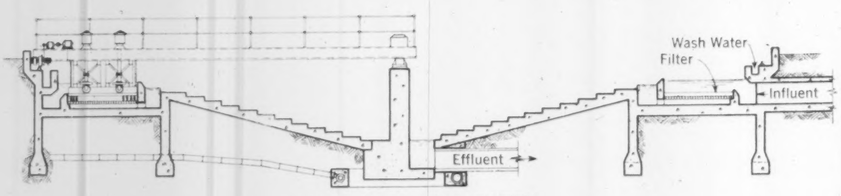


Fig. 5. Final Effluent Filter, with Central Cascade

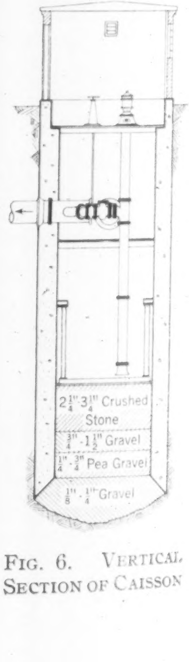


Fig. 6. Vertical Section of Caisson

A Practicing Engineer Looks at Soil Mechanics

Pointing Out Both Its Applications and Its Limitations, and Suggesting a Brief Basic Bibliography on the Subject

By George L. Freeman

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SCIENTIFIC knowledge of soils today rests largely with the younger engineering graduates who have included soil studies in their college training, and with relatively few engineering teachers and specialists. To those who have this specialized knowledge, Mr. Freeman warns, this article will offer little that is new and interesting. It is addressed rather to the large numbers of engineers who are seeking a usable explanation of the applications of scientific soil studies. Mr. Freeman discusses both the value of the new methods and their inevitable limitations. His article is abridged from that presented before the Soil Mechanics and Foundations Division at the Society's Fall Meeting.

As it is hard to teach old dogs new tricks, so is it difficult for the average practicing engineer to inform himself on the new science of soil mechanics and to apply it understandingly in the solution of his problems. He has for many years built foundations of conventional design; he has continued to construct earth dams following age-old methods and without the aid of the knowledge and technique now available for such work; he has continued to satisfy himself of the capacity of piles by single pile tests and of the load-bearing capacity of soils by small-area load tests. Yet in these and many other problems, a working knowledge of the principles of soil mechanics is of great value, guiding the engineer toward safer and more rational methods of design.

The average practicing engineer has little time, and usually less inclination, to devote himself to an exhaustive study of soil mechanics; its mushroom bibliography appalls him and its nomenclature confuses him. Therefore he is frequently uninformed on it; or worse, he attempts to apply his incomplete knowledge of it in his work.

Engineers wishing to inform themselves on soil mechanics may obtain a general knowledge of it by carefully reading a few comprehensive articles published in American technical literature within recent years.

The first orderly, constructive, and comprehensive presentation of the subject in this country was embodied in a series of eight articles by Charles Terzaghi, M. Am. Soc. C.E., published in *Engineering News-Record* in 1925 (consecutive issues from November 5 through December 31). In these articles Terzaghi outlined the physical characteristics of clay soils, explained the relation between the moisture content of clays and load conditions, and the phenomena of settlements of compressible soil foundations.

In 1927 was published, in the Proceedings of the American Society of Civil Engineers, another article by Terzaghi, entitled "The Science of Foundations—Its Present and Future." This article was a general review of the state of the science of foundations, discussing the load-bearing capacity of soils to support spread footings and piles, and emphasizing the fallacy of selecting soil-bearing pressures without reference to the areas loaded, or to the allowable differentials of settlements in structures. It also pointed out the error in assuming that the supporting power of piles could be determined by tests on single piles.

The U. S. Department of Agriculture, Bureau of Public Roads, assembled a group of articles that appeared in *Public Roads* in 1931, and published them in one volume entitled *Reports on Subgrade Soil Studies* (for sale by the Superintendent of Documents, Washington, D.C.). While these articles are of particular value to engineers engaged in highway work, they should be read by any engineer desiring a general knowledge of soil mechanics.

In 1930 a Special Committee on Earths and Foundations was organized by the American Society of Civil Engineers, with Lazarus White, M. Am. Soc. C.E., as chairman, to carry on study and research on soils and foundations. In 1933 the committee published a progress report under the titie "Earths and Foundations" (Proceedings, May 1933). The report dealt with the basic principles of soil mechanics and consolidation of compressible soils under various forms of loading, and discussed methods of sampling soils and testing them in the laboratory.

If the practicing engineer will read the several articles mentioned, he will obtain a fair understanding of the general subject of soil mechanics and the range of its application to his problems.

WHY CLAY SOILS SETTLE

Many soil problems are concerned with the properties of sands and gravels, but far more with clays and silts. These latter materials, because of their sedimentary origin and fineness, may contain large percentages of voids filled with water, rendering them highly compressible under load, and at times slippery and unstable in embankments and excavated slopes.

If additional load is imposed on a natural undisturbed bed of clay, it results in expulsion of the contained water until the voids have been reduced and the clay has shrunk or settled to the point where it is again stable and supports its added load without further settlement. Because of the fineness of the material, the flow of water from it is extremely slow, and settlement may continue for hundreds of years at a decreasing rate. Again, if load is removed from a bed of clay, as may happen when basements are excavated for buildings, the clay below the excavated area may actually swell, increasing its voids and taking up more water, thus becoming less stable than in its natural state.

Granular soils, such as gravel and sand, compress but slightly under added load. Such settlement as does occur takes place immediately and usually has little effect on the supported structure. Mixtures of sand, gravel, and clay may exhibit, under load, the characteristics of either granular or clay soils depending on the percentage of fine materials present and whether or not the course grains are in contact or are separated by clay with its voids and retained water.

A characteristic of clay which is of particular importance in foundation and pile work is the change that takes place in its structure and strength when it is disturbed or remolded. In its undisturbed condition clay may be fairly hard or friable and have definite shear and bearing values, while the same soil if worked and remolded, even without the addition of water, becomes soft, plastic, and very unstable. When constructing foundations on such clay it is essential that the soil at and below the bearing levels be not disturbed. If it is disturbed, its consolidation under the imposed load, and the resulting settlement of the supported structure, may be several times as much as if no disturbance had occurred.

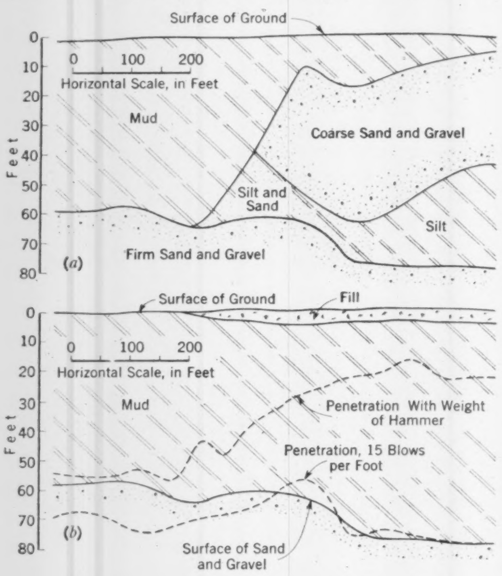

FIG. 1. SHOWING UNRELIABILITY OF WASH BORINGS

(*a*) Conditions as Indicated by Borings
(*b*) Results of Pile Driving Tests

Frequently piles have been used for foundations where actually they were not needed, and were even detrimental because the driving process definitely impaired the supporting value of the natural soil. In spite of a popular conception to the contrary, driving piles into clay does not consolidate it; consolidation can only be effected by expelling its water, which requires infinitely more time than is required to drive a pile. If friction piles are supported in clay, they will support little more or no more weight per square foot of ground area than will the clay itself, and the remolding of the clay around the driven piles definitely weakens its supporting value and increases the settlement of the piles.

When piles are driven in sand and gravel the effect is quite different. These materials consolidate in the zones around the piles, generally improving their supporting value.

Without attempting to be inclusive, I will cite a few instances where a scientific knowledge of soils is needed for the proper solution of engineering problems.

1. *When the engineer plans to support a structure of any magnitude or importance on a compressible soil.* Soil mechanics permits him to determine the maximum load the soil will support without actual failure through movement or displacement; and approximately the amount of settlement to be expected for a given load and the time during which it will occur. As the settlement of a loaded area is not uniform, being less around its periphery than near the center, he will finally apply that intensity of load which will induce settlements, and differentials of settlement, within limits which the supported structure can safely withstand. These comments hold for a design including spread footings, a mat or raft, or any type of pile support in a compressible soil.

2. *When the engineer plans a retaining wall, bulkhead, or cofferdam.* Probably there have been more failures due to faulty design in this group of structures than in all other types combined, if we exclude ordinary settlements. This has been because of a general lack of knowledge of the lateral thrusts from soils, particularly against bulkheads, where the supported soils are frequently soft clays and silts with heavy surcharges. The analyses of the forces to which such retaining structures are subjected is not simple, and may be indeterminate.

Too many out-of-date handbooks are still in use, and too many steel companies are publishing mathematical treatises on this subject which may be improperly applied to specific cases. It is far safer for the engineer to utilize in his design first-hand scientific knowledge of the soil. He should determine its cohesive properties, its internal friction, and finally arrive closely at its angle of repose and the lateral thrust it may exert. Through a knowledge of the shearing strength of the soil, he can determine the safety of the structure against failure caused by a deep rotational movement, the source of many bulkhead failures.

3. *When the engineer plans an earth fill dam.* He will determine the fineness gradation of the soils which compose the fill, and the perviousness of the compacted material as well as that of the soils, if any, on which the fill is supported. Through the method developed by Ralph R. Proctor, M. Am. Soc. C.E., commonly called the Proctor method, and described by him in four articles in *Engineering News-Record* in 1933, the engineer can then determine, and maintain during the placing of the fill, the optimum moisture content and the amount of rolling or tamping necessary to produce best compaction of the soil. He can also determine the upstream and downstream slopes of the embankment which will be safe against sliding or sloughing.

4. *When the engineer plans a highway.* Through methods developed by the U. S. Bureau of Public Roads, and by the highway departments of various states, he can determine the stability of subgrade soils against frost heaving and softening when saturated, and the stability of embankments and slopes of highway cuts. If a section of the highway is over soft ground, the principles of soil mechanics will apply to the problems of settlement and safety of foundation strata against failure.

STEPS IN THE DEVELOPMENT OF FOUNDATION DESIGNS

The solution of a foundation problem—where there actually is a problem—may be divided into four general steps:

1. Field investigations, including borings, test pits, and test loads
2. Laboratory tests and plotting of results
3. Study and interpretation of laboratory and field tests
4. Design of the foundation

Of course, laboratory soil tests are not always indicated, and the engineer must judge when they are needed and when they are not. They are obviously unnecessary when a structure is to be supported on rock, hardpan, or other non-compressible materials, the load-bearing capacity of which is known to be ample. They are obviously needed when good foundation materials cannot be reached at a reasonable depth and it appears necessary to provide support through direct bearing on, or piles driven into, compressible soils. In the range between these two extremes the engineer's course of action must be guided by his judgment and experience. If good bearing soil lies but a few feet below the surface, it is usually better to found the structure on it than on a less stable stratum above. If the good bearing soil lies deeper, but can be reached economically by piles, they should be driven into it, and should function through end bearing and friction, with no dependence on the softer soil above.

For granular, non-compressible soil, small-area load tests will ordinarily suffice to establish the safe soil-bearing capacity. If piles are to be used, supported in good granular soil, tests by driving and loading single piles may be sufficient to establish their supporting values. In either case test loads should be well in excess of (say $1^1/_2$ or 2 times) the unit loads imposed by the structure to be supported, and should remain in place until there has been no settlement for at least 24 hours. Soil borings should be made to sufficient depths below the subgrades of the footings, or below the tips of piles, to prove the presence, or the absence, of deep compressible soil strata which might consolidate and cause settlement due to the added loads.

Where a structure is to be supported directly or indirectly on compressible soil, more elaborate field work is needed. The engineer's problem is to determine whether the soil will support the structure with any economical load distribution, and if so, what the proper unit load is, what settlements are to be expected, and what differentials of settlement will occur between parts of the structure.

And now the soil mechanic and the "Hill Billy" contractor come into the picture. The Hill Billy contractor will decide the whole matter by making a soil load test. He puts a load of 3 tons on a 1-ft square block, and along in the afternoon, with his rule and carpenter's level, he finds only $^1/_8$ in. of settlement. "O.K.," he says, "we'll be safe if we take half the test load, or $1^1/_2$ tons per sq ft, for our unit foundation load." Or perhaps it is a pile job—in which case the contractor takes his little double-acting steam hammer, with its 800-lb ram, and hammers home, according to the hoary old Engineering News formula, a pile weighing around 1,500 lb. "There's your pile," he says, "only 45 ft long, but we'll buy them 50 ft long to be safe."

But the soil mechanic knows better. He knows that the 1-ft square test block would continue to settle for a much longer period, and that even if it were left until settlement ceased, its settlement would not be the same as that over a large area loaded to the same intensity. And he knows the pile test is undependable for several reasons: (1) the inertia of the heavy pile absorbs much of the inertia of the hammer blow, leaving little of the driving force to move the pile in the ground; (2) the pile formula makes no allowance for energy losses in equipment or in the pile itself and therefore is not a reliable measure of the actual supporting power of the pile; and (3) even if the first two objections were eliminated, and the pile would apparently support its intended load, that load is in turn supported by a compressible soil, probably remolded in the vicinity of the pile, and settlement is bound to occur over a period of years. And there is a fourth very important objection; while a single pile may support its unit of load, a group of piles loaded to the same unit capacity may overload the supporting soil and cause failure.

IMPACT PILE FORMULAS AND HOW TO USE THEM

A striking instance of the fallibility of results determined by an impact pile formula came to my attention in August 1938, when piles were being driven for the support of the main pier of an important bridge in New York City. The piles were 10-in., 42-lb H-beams about 60 ft long, driven with an 85-lb H-beam follower 40 ft long, the tops of the piles stopping about 32 ft below water level. The combined weight of pile and follower was about 6,100 lb. The specifications called for driving the piles to a 50-ton capacity in accordance with the Engineering News formula, and also for them to be driven to the penetration required by the engineer. Fortunately this latter clause was enforced.

The greater part of the piles were driven with a double-acting steam hammer delivering a rated blow of about 13,000 ft-lb, 200 to 300 blows per foot being required to secure the penetration ordered by the engineer. The formula would rate these piles good for 80 to 93 tons each. Subsequently the contractor changed hammers, using a heavier double-acting hammer striking a rated blow of 19,850 ft-lb. With this rig the piles took, for the same depth of penetration, around 50 to 60 blows per foot, and were good, under the formula, for 58 to 66 tons each. Here were two different sizes of hammers, driving the same piles in the same ground and to the same depth of penetration. Judged by the same pile formula, the piles driven with the light hammer were good for 80 tons, while those driven with the heavy hammer could support only 58 tons, a difference of nearly 40 per cent.

The simple form of the Engineering News formula has naturally led to its general adoption by engineers and builders. But they have relied too much on its guidance and frequently discover that they have been led astray. If a pile-driving formula is to be used, it should be in such form that the net load capacity of the pile can be determined after deducting the many necessary losses common to the pile-driving process; and whatever its form it must always be used with caution and intelligence and its results must be verified wherever possible by actual load tests.

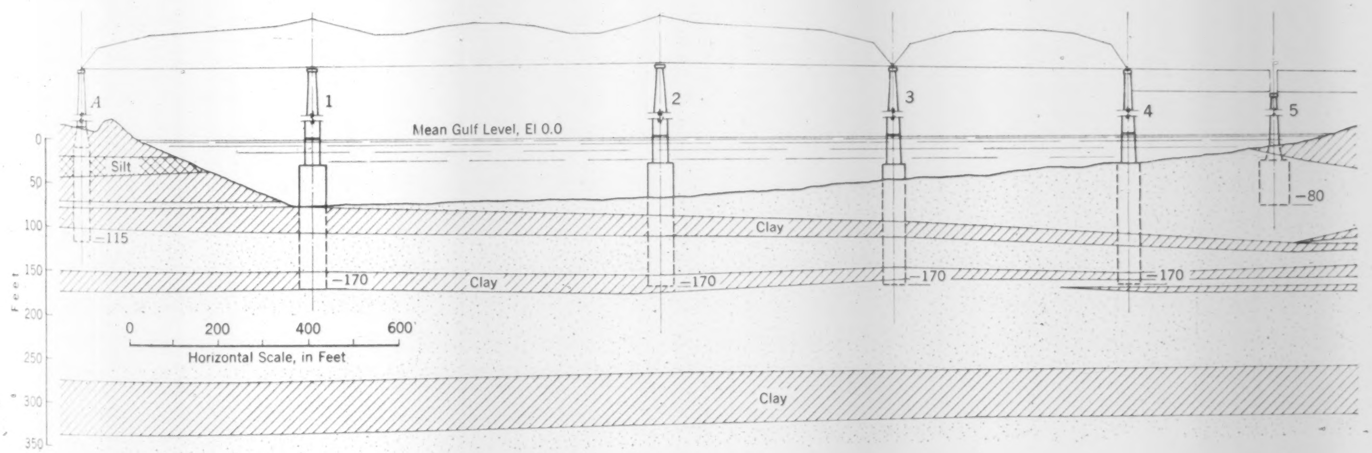

Fig. 2. Soil Profile, Huey P. Long Bridge

But to get back to our soil mechanic. He explains that he must obtain some undisturbed samples of the clay soil to test in the laboratory. "Sure," says the contractor, "I'll get them. I'll drive a 2-in. pipe down there about 25 ft and we'll have a good sample." But again the soil mechanic knows better. He proceeds with a series of soil borings sufficient for a general exploration of the site. Most of them are wash borings, with dry spoon samples taken at stated intervals to check the soil stratification; a few are large-diameter borings from which typical undisturbed samples are recovered for laboratory tests.

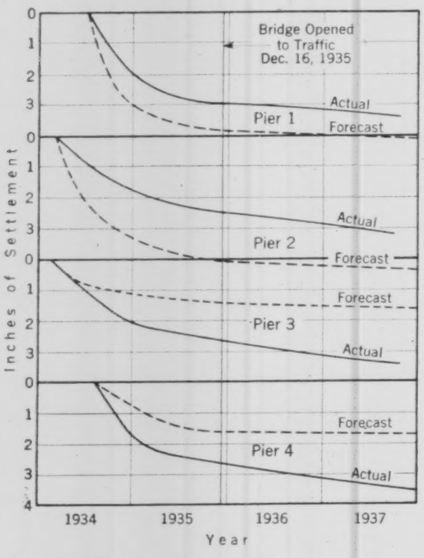

FIG. 3. COMPARISON OF FORECAST AND ACTUAL SETTLEMENTS AT HUEY P. LONG BRIDGE

The importance of care and skill in obtaining samples from soil borings cannot be overemphasized, as they are usually the only source of information on the character of the soil substrata. Wash borings, depending on the skill of the driller, may yield information that is fairly good—or notoriously bad, as shown in Fig. 1. This drawing depicts an actual case which occurred on a bridge job within the past two years. Wash borings showed soft mud only a few feet deep over part of the area, and under that, course sand for a depth of 40 to 50 ft, where another stratum of silt was found, and then a firm sandy bottom. Viaduct piers and an abutment were originally planned to bear directly on the sand a few feet below the surface. While test piles for adjacent piers were being driven, the high-level sand was not encountered; instead, timber piles dropped 25 ft under the weight of a heavy steam hammer before a blow was struck, and piles 70 to 80 ft long were required to develop a 15-ton capacity.

A suitable method of obtaining undisturbed soil samples has been, and continues to be, a subject for much study and investigation. The latest activity along this line is the program of study started by M. J. Hvorslev, Assoc. M. Am. Soc. C.E., for the Soil Mechanics and Foundations Division of the Society. So-called "undisturbed samples" from borings are today being obtained with special devices and with fair success, but none, so far as known, in a truly undisturbed condition. The author's firm ordinarily specifies a 3-in. diameter sample tube, the sample being later shaved down to fit a $2^1/_2$-in. consolidation device. Samples split lengthwise always show a typical drag or distortion around the skin for a depth of $^1/_8$ to $^3/_8$ in., and some times more. Samples of larger diameter are certainly to be desired, and no doubt would be generally obtained were it not for the added expense, to which clients usually object.

Where it is feasible to dig test pits into the stratum to be investigated, samples can be carved out which are in better condition than those recovered from borings. This method, however, is obviously limited in its application.

Soil samples must be delivered to the laboratory as nearly as possible in their natural condition, and therefore must be tightly sealed as soon as recovered from the hole, and gently handled during shipment and delivery, as shock may disturb the soil and upset the laboratory results.

LABORATORY TESTS AND THEIR INTERPRETATION

The soil testing methods practiced by the several American laboratories are not uniform; however their objectives are the same. They determine the distribution of grain sizes in soils. They subject samples to consolidation tests, from the records of which charts can be prepared showing how much a bed of similar soil will consolidate or settle under a given load, and the time required for such consolidation. They determine the strength of the soil by crushing unconfined cylinders or cubes, and its shearing strength by shearing samples of known areas in specially contrived containers. They test the permeability of natural and artificial soils. And they have fairly well settled on a series of short-cut tests by which soil characteristics can be identified and compared, thus frequently avoiding a repetition of more time-consuming operations.

With the results of the laboratory tests available, and a knowledge of the principles of soil mechanics, the engineer can intelligently adapt his foundation design to the soil conditions at the site. He must know the limitations of his structure to withstand differentials of settlement and support it accordingly—going to firm bearing soil if necessary, regardless of cost.

In interpreting the results of laboratory tests, considerable latitude must be permitted as the performance data from the tests apply only to the soil actually contained in the tested samples. If the soil mechanic says settlement will occur, he is probably right. If he says the settlement will be 8 in., he is guessing—it may be 4 in. or 12 in., or some other amount.

The difficulty in evaluating the degree of compressibility, and the extent of compressible soil under a structure, may be visualized by a study of a typical soil section at the site of the Huey P. Long Bridge (Fig. 2). At that location the soil formation consists of sand with layers of clay at various depths. In Fig. 3 are shown the forecast settlements for Piers 1 to 4, together with the actual settlements up to October 1937. It will be seen that the actual settlements of Piers 1 and 2 are less, while those of Piers 3 and 4 are greater, than those forecast. The differences run about 2 in. in settlements of the order of 4 in., and do not appear excessive considering the varying character of the soil and the small magnitude of the settlements involved.

CHECKING PERFORMANCE AGAINST FORECAST

In the lack of correlation between forecast and actual performance lies one of the present weaknesses of soil mechanics—the soil expert estimates settlement, or lateral thrust, or some other factor, but seldom has an opportunity to check his forecast against actual results. It is highly desirable that, in each locality, foundation and performance data for typical structures on compressible soils should be collected and recorded so that engineers can correlate actual performance with the results of their soil tests. These data would then be available as a guide to more complete understanding of the properties of local soils, and to better and safer foundation designs.

Owners of structures are not usually interested in obtaining such records, and individual engineers cannot ordinarily afford the necessary expenditure of time and money. The records must therefore be obtained by the organized effort of municipalities or engineering bodies interested in the advancement of foundation engineering.

Concrete Beams with Sheet-Steel Web Plates

Comparative Tests Indicate Several Advantages Over Beams with Conventional Stirrups

By J. TRUEMAN THOMPSON, M. AM. SOC. C.E., THOMAS F. HUBBARD, ASSOC. M. AM. SOC. C.E.,
and JOHN N. FEHRER, JUN. AM. SOC. C.E.

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A RATHER radical departure in the design of beam reinforcement—the substitution of web plates for stirrups—is reported here. Tests made thus far indicate that the beams with web plates are superior in structural action—and it is shown also that such beams are simpler to construct and offer minor economies in both labor and materials. The authors acknowledge that their data are limited, and express the hope that others with better facilities will extend the research.

THIS article embodies the results of a number of tests made to compare the behavior of beams having thin steel plates for web reinforcement with those of conventional stirrup design. The dimensions and steel layouts of the test specimens are shown in Fig. 1, and in Table I the web reinforcement used in each beam is described.

For convenience the test specimens were divided into two general groups: Series I, in which the longitudinal bars had 8-in. diameter hooks on both ends, and Series II, in which the bars were straight, their lengths being increased to secure sufficient anchorage. In Series I three types of beams were made: those having no web reinforcement, those having the conventional U-stirrup arrangement (designed in accordance with the Recommendation of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, 1924), and those having web reinforcement consisting of steel plates, both perforated and unperforated, ranging in thickness from 1/64 to 1/16 in. It was noticed in the first series that most of the web-plate beams split at the plane of the plates at ultimate loads. Since this was observed only at stages far in excess of design loads and occurred with the final disintegration of the beams, it was not considered as detracting from the general desirability of the web-plate type of construction.

The splitting was thought to be due to the large hooks on the ends of the main bars, and Series II was an attempt (which subsequently proved unsuccessful) to eliminate the splitting by the use of straight bars. In this series it was not thought necessary to repeat the stirrup group or two of the less satisfactory web-plate designs. The type with 1/64-in. plates was omitted because it had shown a relatively low ultimate strength and also because these plates were considered too thin for practical handling in the field. The type with 1/32-in. plates and 1/4-in. perforations was also dropped because it seemed less advantageous than the type with plates of the same thickness but with 1/2-in. perforations. Also, in Series II, the opportunity was taken to study the relative advantages of flanged and unflanged plates.

TABLE I. DESCRIPTION OF WEB STEEL

Beam No.	Web Reinforcement Used: Type	Shape	Thickness, Inches	Wt. Per Beam, Lb
	Series I			
A*	4 plates, solid	][	1/16	22.12
B	None used	...	..	....
C	14 stirrups, round	⊔	1/4 (Dia.)	6.82
D	2 plates, solid	∫	1/64	2.76
E	2 plates, solid	∫	1/32	5.53
F	2 plates, 1/4-in. diameter perforations	∫	1/32	2.57
G	2 plates, 1/2-in. diameter perforations	∫	1/32	2.67
	Series II			
H1	2 plates, solid	∫	1/16	11.06
H2	2 plates, solid	|	1/16	9.36
I1	2 plates, solid	∫	1/32	5.53
I2	2 plates, solid	|	1/32	4.68
J1	2 plates, 1/2-in. diameter perforations	∫	1/32	2.67
J2	2 plates, 1/2-in. diameter perforations	|	1/32	2.26
K	None used	...	...	....

* Plates in beams A were spaced 4 5/8 in. back to back.

Beams in Group A of Series I differed from the other web-plate beams by having two plates at each end instead of one, and were so designed that strain gages could be fastened to the plates. Groups B and K, with no web reinforcement at all, were constructed to determine the shear carrying capacity of the concrete alone. Group C, with conventional stirrups, was used as a standard or yardstick with which the web-plate beams could be compared.

The longitudinal bars, stirrups, and web plates were all of structural grade steel. The cement was a reputable brand of portland, satisfactory in all respects. Aggregates consisted of a washed gravel graded from 3/4 in. down, and a clean, rather coarse, sand. The resulting concrete showed an average crushing strength of 2,570 lb per sq in. and an average modulus of elasticity of 3,400,000 lb per sq in. at 28 days.

Before being placed in the form, the reinforcing was assembled into a rigid unit (Fig. 2). In beams of Group A the four plates were symmetrically placed in the cross-section, and were fastened to the outside bars. However, in the other web-plate groups, because only one plate was used at each end, it was more convenient to fasten them to one of the inner bars, thus making them 1/2 in. off center.

The specimens were kept in the forms approximately 48 hours before stripping, and during this period were covered with wet burlap. They were then moist cured at 70 F until tested.

THE TESTING PROCEDURE

A photograph of the apparatus assembled for the flexure tests is shown in Fig. 3. It consisted essentially of a steel frame; a 75-ton journal jack with which to apply the load, and a 50-ton loadometer to measure it; a heavy H-section to transfer the load to the beam at its third points; and rounded bearing blocks which, together with the spherical head between the jack and the loadometer, prevented load eccentricity.

In Group A, strain measurements were made on the web plates. A portion of the steel plates about 2 in. in diameter was exposed at a point *C*, 12 1/2 in. from the end bearing and 4 1/2 in. from the bottom of the beam. Here a strain gage was mounted on each side of the beam, a 1-in. gage length being used. The gages were arranged so that they could be set at any desired angle, with point *C* bisecting the gage length. Strains caused by a load of 15,000 lb were first measured. With this load and starting the gages horizontal, readings were taken at each 15-deg interval until a complete revolution was made. This procedure was repeated successfully with a load of 25,000 lb, but when the load was increased to 35,000 the concrete evidently had cracked enough to destroy the homogeneity of the beam because the readings were very inconsistent.

After measuring the strains at point *C* for repeated loads of 15,000 and 25,000 lb at the 15-deg gage intervals, the gages were set as near as possible to 57 deg 15 min, the theoretical angle of maximum tension, and read, as were the deflection gages, at every 5,000-lb load increase. They were left attached to the beam as long as was considered safe.

Strains were also measured in the fourth stirrup of the beams in Group C, $4^1/_2$ in. from the bottom of the beam. This location was chosen, and procedure similar to that just described was followed, in order to compare strains for like loads at the same point in the two kinds of webs. Strain measurements on the stirrups were not significant, as will be shown later.

Deflections were measured at the middle and quarter points of all beams by means of deflection dials suspended from a light steel bar. Each end of this bar was attached to the beam at the intersection of the neutral axis and the line of support and was therefore unaffected by beam deflections. The load was applied in increments of 5,000 lb at a constant rate and the gages read at each increase.

DISCUSSION OF TEST RESULTS

Three 6 by 12-in. control cylinders were made with each beam. Test results for modulus of elasticity and for compression were very uniform, the average variations being 6 per cent and 3 per cent, respectively. This indication of good control was further emphasized by the tests on the beams. In cases where such tests were made, comparable strain measurements on web plates were almost identical before homogeneity was destroyed. Deflections and breaking loads for individual specimens having the same web reinforcement were likewise very uniform.

Knowing the modulus of elasticity of both the concrete and the steel, beams in Group A were analyzed by means of the "transformed area" method for (1) variation of strains at point *C* through a range of 360 deg for loads of both 15,000 and 25,000 lb; (2) variation of strain at 57 deg 15 min (the theoretical angle for maximum strain) with increasing loads; and (3) deflections at the middle of the beam with increasing loads.

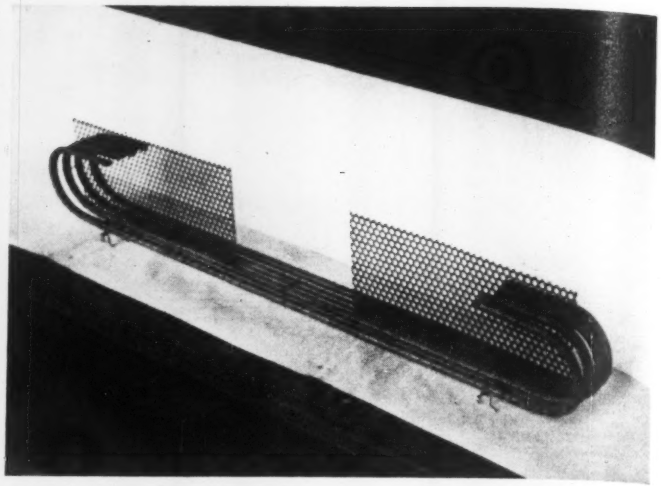

FIG. 2. REINFORCING ASSEMBLY

A comparison of the theoretical results obtained by transformed area analysis and observed data revealed a remarkably close correspondence, from which it would appear that this method may be employed to predict with accuracy the stresses and deflections in simply supported reinforced concrete beams at loads below those at which homogeneity is destroyed by cracking. Because of their necessarily voluminous nature, the detailed computations involved in the theoretical analysis are omitted here. (They are given in the original report of these tests, "Tests of Concrete Beams with Steel Web Plates," an essay submitted by Mr. Fehrer in partial fulfillment of the requirements for the degree of master of civil engineering, the Johns Hopkins University, 1937.)

In seeking a means of comparing and contrasting the structural behavior of the various beams, the authors were aware of the inadequacy of basing conclusions entirely on ultimate strength. Behavior up to or somewhat beyond the point of reasonable working loads, which has been computed as approximately 25,000 lb, seems to them a much better basis. This is kept definitely in mind in discussing the results of these tests.

In this connection it was observed that web plates started taking their share of load immediately, the strains increasing uniformly with load up to the point where the concrete started to fail in tension, then more rapidly as cracking progressed, until finally the plates assumed practically all the web tension.

This was in sharp contrast to the action of stirrup-reinforced beams. There the measured strains were erratic from the very inception of loading, being sometimes compressive, sometimes tensile, but always negligible in amount until the first appearance of shear cracks, at which time they suddenly assumed high values. It might be said that the stirrups were in fact inoperative until diagonal tension cracks occurred.

The load-deflection curves are plotted for each type of beam in Fig. 4. Detailed study of these data, excluding Group A because the concrete was over age, showed that up to a load of 30,000 lb (the computed safe working load is 25,000 lb) the deflections of all web-plate beams were essen-

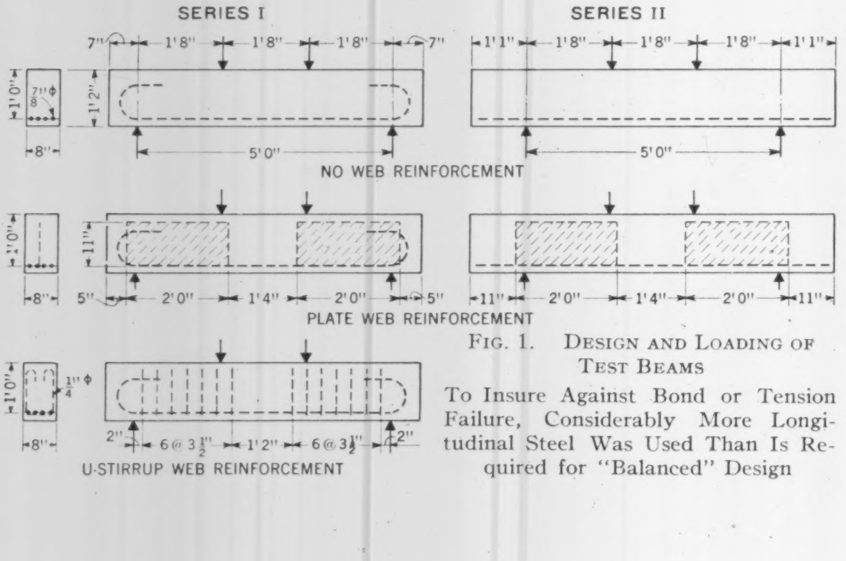

FIG. 1. DESIGN AND LOADING OF TEST BEAMS

To Insure Against Bond or Tension Failure, Considerably More Longitudinal Steel Was Used Than Is Required for "Balanced" Design

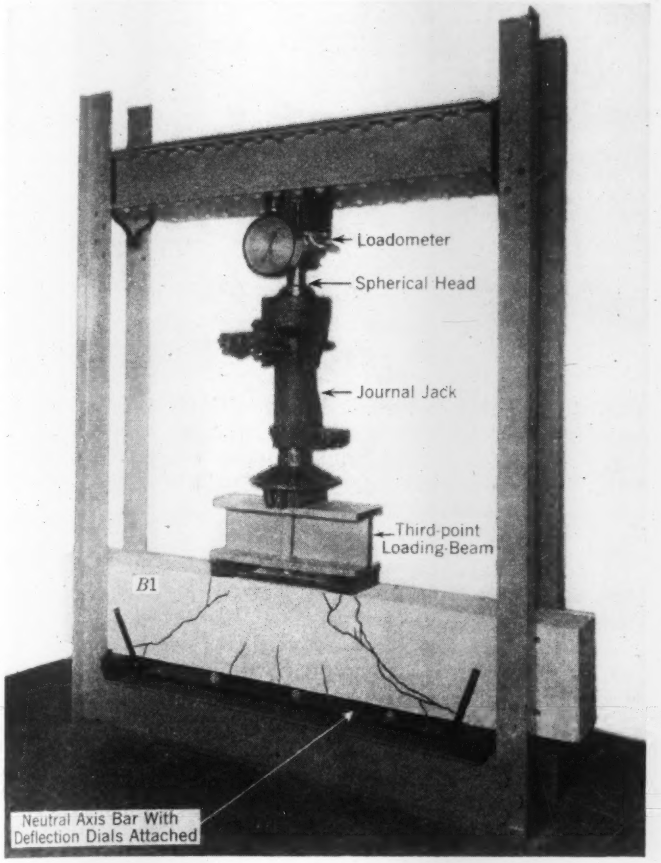

Fig. 3. Apparatus for Flexure Tests

tially identical and equal to the deflections of the stirrup type. At this load the deflections of the beams without web reinforcement (Groups B and K) were a little greater.

A comparison of loads carried at equal deflections up to the ultimate load of the weakest beam showed them to be remarkably consistent regardless of whether stirrups or plates of any thickness or shape were used. This ultimate load was approximately 75,000 lb, or about three times the safe working load.

Since the web plates are equally satisfactory as regards deflections, and since they take their share of load from its inception instead of remaining inactive until shear cracking occurs as the stirrups do, it would seem that the advantage lies with the web-plate beams so far as structural action is concerned. Even beyond a point three times as great as working loads, the web-plate beams on the whole demonstrated a "toughness," or resistance to final failure, at least as great as that of the stirrup-reinforced group.

Table II gives ultimate loads, corresponding ultimate shearing stresses, and the manner in which each type failed. Coupled with the strain and deflection information already discussed, it leads to several additional observations.

The falsity of basing final judgment upon ultimate loads is brought out by noting that types B and K, with no web reinforcement, developed higher apparent ultimate shearing stresses than did two of the types with web reinforcement. But it must also be noted that they failed suddenly and the load dropped immediately from a high peak value to a very low value. The lack of resistance to utter and sudden collapse of beams without web reinforcement is emphasized when their failures are compared with those of beams with web reinforcement.

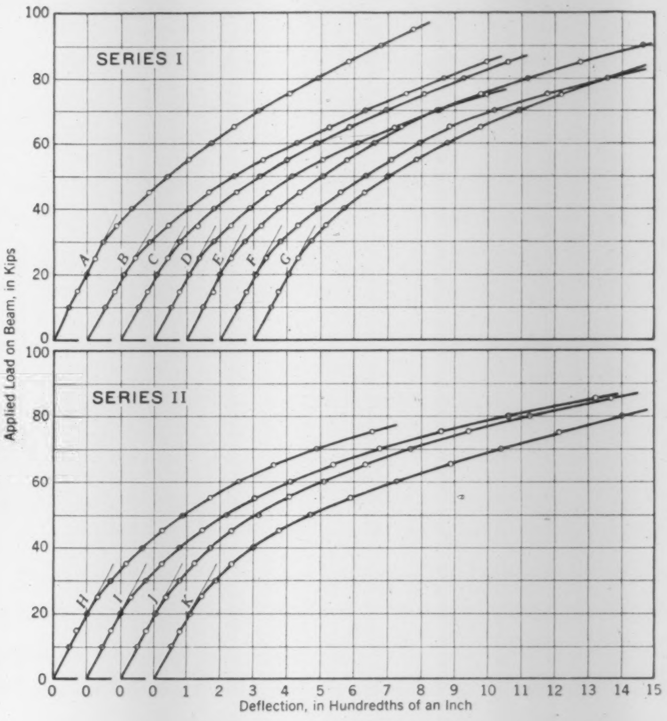

Fig. 4. Average Deflection of Beams at Mid-Point

Age of All Beams at Test Was 28 Days, Except Group A, Which Was Tested at 74 Days

Table II. Ultimate Strength of Beams and How Failures Occurred

Age of Specimens at Tests, 28 Days

Beam Number	Ultimate Loads on Beams, in Pounds		Computed‡ Av. Ult. Shearing Strength Lb per Sq In.	Manner in Which Failure Occurred
	Individual	Average		
			Series I	
A2* A3*	115,000+† 115,000+†	115,000+	750+	Load maintained at 115,000 lb† for 35–50 min; no failure
B1 B2 B3	84,000 88,000 86,000	86,000	560	Failure occurred suddenly, load fell to about 5,000 lb immediately
C1 C2 C3	97,000 88,000 98,000	94,300	620	Load fell off rather rapidly to 50,000–60,000 lb
D1 D2	76,000 82,000	79,000	520	Load dropped slowly to about 65,000 lb, then rapidly to 40,000
E1 E2	93,000 110,000	101,500	670	Load fell off rather rapidly to 40,000 lb
F1 F2	94,000 82,000	88,000	580	Failed suddenly and load fell to 30,000–35,000 lb
G1 G2	100,000 106,000	103,000	680	Load dropped slowly to about 70,000 lb, then rapidly to 50,000
			Series II	
H1 H2	88,000 80,000	84,000	550	Failure occurred slowly, load dropping to 50,000 lb
I1 I2	86,000 93,000	89,500	590	Failure occurred slowly, load dropping to 55,000 lb
J1 J2	103,000 108,000	105,500	690	Load dropped slowly to about 65,000 lb, then rapidly to 45,000
K1 K2	88,000 84,000	86,000	560	Failure occurred suddenly, load fell to 8,000–12,000 lb immediately

* Age at test, 74 days. † 115,000 lb was the capacity of the machine. ‡ $v = V/jbd$ where j was computed for parabolic distribution of compressive bending stress, assumed to correspond to ultimate loads.

In the latter, failures were generally slow and sub-peak values relatively high.

Flanging the web plates seems unnecessary. In the H-type beams, the flanged plates developed a somewhat higher ultimate shearing strength, but in the I and J types the reverse was true.

Perforating the plates with $^1/_4$-in. holes did not seem to be advantageous. Plates with $^1/_2$-in. perforations, when compared with unperforated plates, seemed in general to develop somewhat higher ultimate strengths; however, in view of the materially greater cost entailed in punching, and the dubious advantages as measured by ultimate load criteria, it is believed that perforations may be omitted.

Thickness of plate does not seem to be important. For example, one of the beams with $^1/_{64}$-in. plate developed a higher ultimate load than another with a plate thickness of $^1/_{16}$ in. In this connection it may be pointed out that strain measurements made on web plates indicated a stress of less than 2,000 lb per sq in. at working load. In any event the stress in the bottom edge of the plates cannot exceed that in the main bars and cannot possibly cause tearing at working loads. Indeed no web plate failed in tension in these tests. It is concluded that the minimum web-plate thickness should be governed by such items as ease of handling and setting, and likelihood of corrosion.

In Fig. 5 is given some interesting information on the distribution of stress when different methods of web reinforcement are used. The web plates affected the beam very much the same whether solid or perforated. It was observed that a crack first appeared very close to the middle of the beam, then two more developed beneath the loads, and finally the diagonal tension cracks were formed. As the load was increased they all lengthened until the neutral axis was reached. Here the three central cracks stopped, but the diagonal ones continued to grow until the area of the concrete at the top of the beam became so small that the concrete failed in either compression or shear. As evidence of the degree to which stress is equally distributed by the web plates in contrast to the stirrups, it was observed that in practically every case beams of the former type failed simultaneously in both outer thirds of their length, whereas those of the latter type usually did not. In the stirrup beams the three central cracks did not all rise to the neutral axis, and while one diagonal crack developed on one side, several formed on the other. It was on the latter side that the beam invariably failed. The beams without web reinforcement simply developed diagonal tension cracks which continued to rise until failure suddenly took place.

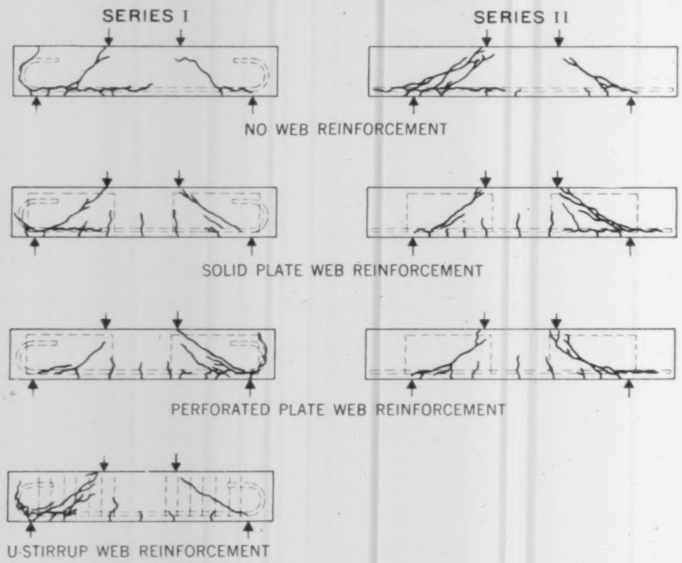
SERIES I
SERIES II
NO WEB REINFORCEMENT
SOLID PLATE WEB REINFORCEMENT
PERFORATED PLATE WEB REINFORCEMENT
U-STIRRUP WEB REINFORCEMENT

FIG. 5. TYPICAL BEAMS AFTER FAILURE

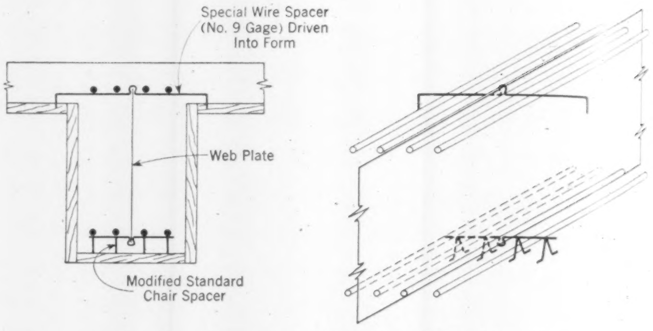
Special Wire Spacer (No. 9 Gage) Driven Into Form
Web Plate
Modified Standard Chair Spacer

FIG. 6. METHOD OF HOLDING WEB PLATES

PRACTICAL IMPLICATIONS OF THE TEST RESULTS

Among the practical advantages of the substitution of web plates for stirrups are simplicity of both design and construction, accuracy in placing the plates, and a saving in labor. Bars which in conventional design are bent up for the double purpose of providing web steel and negative reinforcement may be replaced by a separate set of steel bars used for the latter purpose only. Further, for a given size of main reinforcing bars and a specified minimum transverse spacing, a narrower beam may be used because of the elimination of the two vertical legs of the stirrups, which usually lie outside the main bar group. In this connection it is worth noting that one of the commonest types of failure of reinforced concrete structures is that due to placing stirrups too close to the sides of beams.

Since the web steel constitutes only a small part of the total reinforcement in most structures, no significant differences in either weight or cost may be anticipated, but whatever differences do exist will no doubt be in favor of the web-plate type of construction. This statement is based in part upon estimates of cost and unit bid prices on a small building 100 by 100 ft in plan and 60 ft high, consisting of reinforced concrete footings, columns, roof, and floors (of slab, beam, and girder type) and brick curtain walls. The estimated cost was $150,000. A comparison of the affected items is as follows:

ITEMS	STIRRUP DESIGN	WEB-PLATE DESIGN	DIFFERENCE	PER CENT
Total weight of reinforcement, lb	306,600	299,200	7,400	2.4
Weight of stirrups only, lb	28,600	....	...	...
Weight of $^1/_{32}$-in. unperforated plates only, lb	.....	21,200	...	...
Total cost of reinforcement in place	$11,580	11,360	220	1.9
Cost of web steel only, delivered to site	860	680	180	21.0
Cost of web steel only, in place	1,080	860	220	20.4

A suggested means of holding the web plates in place by means of a modification of the standard chair spacer at the bottom, and a special wire spacer at the top, is shown in Fig. 6.

The authors recognize that their observations are based upon data limited both as to types studied and as to size and number of specimens. For this reason no attempt has been made to suggest either a theoretical or an empirical method of design for web-plate beams. Their effort has been directed mainly toward focusing attention on a type of construction which they believe has merit as regards both structural behavior and simplicity. It is their hope that others with better facilities may extend the research.

Initial Investigations and Economical Planning of Hydroelectric Plants

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HYDROELECTRIC power development has been seriously handicapped by the promulgation of a few uneconomic and misplaced projects without proper regard to their function in the already developed power systems of the region. Rare indeed is the water power site that can be exploited profitably as an isolated project. Its true economy lies rather in its development as a part of a system, in coordination with other methods of energy generation. In the accompanying article, Mr. Larned describes the major problems that must be considered in determining whether a given hydro plant is a necessary and desirable adjunct to a system. He emphasizes the importance of intelligent long-range planning of new installations, based on sound business principles, and the necessity for simplifying the design of hydro plants to the utmost in order to reduce costs and to keep pace with similar progress in steam and Diesel development. The article is abstracted from a paper on the Power Division program at the 1938 Fall Meeting.

HYDROELECTRIC power plants, whether promoted by private enterprise or conceived by public agencies in conjunction with auxiliary projects such as navigation, flood control, or irrigation, must be intelligently planned as a component part of the existing power systems of the region in order to be economically sound and to fully utilize the available natural resources. Considered individually, and in competition with steam as an alternate method of generation, the hydro plant can very seldom be justified from an economical standpoint unless the physical features of the site are extremely favorable, or the fuel costs for thermal plants are unusually high.

The decision as to whether or not a particular hydroelectric power site should be developed must be based primarily on a comprehensive initial study of the load requirements and the existing facilities of the region along with an intelligent and unbiased forecast of possible future requirements of the interconnected system. Such a study is an indispensable prerequisite to the technical problems of the design of plant and determines the basic decisions regarding number and size of units as well as the type of plant most adaptable to the needs of the system.

A résumé of the principal points to be considered in an initial investigation will indicate the importance of a definite preconceived plan of capacity development such that capital expenditures can be maintained at a minimum, consistent with adequate service, and at the same time there will always be provisions on the system for the rapid installation of generating facilities to meet all possible load conditions.

The first essential in planning new capacity is a thorough knowledge of load conditions on the system. Since machinery installation must at all times be adequate to meet the maximum demand, the principal data to be considered pertain to peak-load requirements. The usual practice is to utilize the records of maximum monthly one-hour peaks, and these should be plotted for as many years back as there are reliable data available. Such a chart will give an indication of the general trend of the load, and furnish the basic data for predictions of future system requirements. (See Fig. 1.)

In predicting the requirements of system peaks, engineers often project a trend into the future either by compounding the growth at a constant percentage per annum or by extending the trend on a straight-line basis. Either method may, and often does, lead to an absolutely erroneous result. Within the past few years, in attempts to justify huge hydroelectric undertakings which would otherwise be questionable, load growth predictions have been made by compounding annually some assumed rate of growth. If money is being spent in anticipation of such load growth, it is very likely that only disappointment can be expected from such forecasts.

THE "S" CURVE OF LOAD GROWTH

The shape of the load growth curve is more likely to be in the form of an "S" curve similar to that developed by Raymond Pearl after exhaustive studies of population growth and described in his book, *The Biology of Population Growth*. Uusually a load curve taken over a sufficiently long period of time indicates a relatively slow rate of growth in the first years of an undertaking, a more rapid growth when the business is well established, and a diminishing rate as it approaches a saturation point—unless new conditions are encountered as the business begins to satisfy market demands. Past experience shows that the S-curve gives a very close general approximation of what is to be expected over the long range. If a new and unexpected block of load comes onto the system, this merely shifts the curve upward as a whole but does not necessarily alter its general shape.

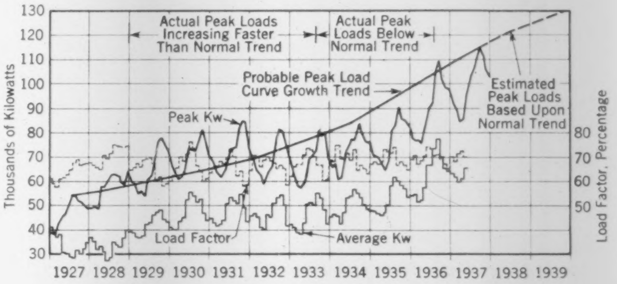

Fig. 1. An Interconnected System Load Curve for 11 Years, Providing a Forecast for Two Additional Years

While a curve of this character gives the general trend of load growth, it naturally does not indicate sporadic departures from the trend due to times of depression or periods of great business activity. Figure 1 shows the actual load growth of a typical interconnected system following in general the S-shaped curve with departures from the trend occurring during severe business changes. It also indicates a logical and conservative forecast for two additional years of peak-load growth. Within the past decade engineers have had sufficient sad experiences to convince them that long-time forecasts must be made with extreme caution, with the result that now they are reluctant to predict system load requirements for a period of more than three or four years in advance.

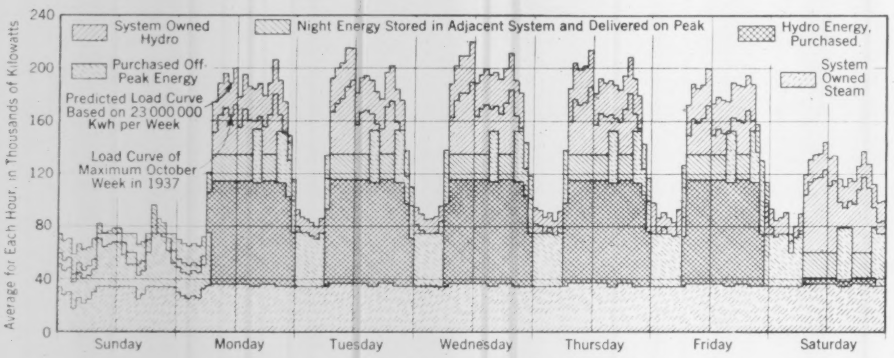

FIG. 2. A TYPICAL WEEKLY LOAD CURVE
Showing Position of Water- and Steam-Generated Energy

With the probable peak-load requirements of the system determined upon a rational and conservative basis, the next step in the initial investigation is to analyze the energy requirements. This necessitates taking into account the daily fluctuations of load as well as the seasonal variations in load factor. Figure 1 indicates the changing trend in seasonal load from month to month and the changing load-factor requirements of the system. Figure 2 illustrates a typical maximum weekly load curve in an interconnected system including both hydro and steam capacity augmented by purchased power from neighboring systems. During periods of ample flow, the hydro capacity usually carries the base load, and in periods of minimum flow, it carries the low load-factor peak portion of the load. By following this method of operation, the greatest benefit is secured from the available water. A study of weekly and monthly load curves for various seasons of the year enables the engineer to estimate the load-factor requirements of the new station, and the seasonal and weekly storage that must be provided during periods of low flow.

It is next necessary to study the class of power required, whether firm or secondary, and the location of the markets for each type. This phase of the work entails a careful study of the transmission system and the distribution of the loads at the various substations in order to determine the diversity and center of gravity of the demand. This has an important bearing on the preferable location of new plant installations.

Many other factors must also be taken into consideration in predicting loads, including the contractual requirements in regard to emergency standby service, probable sale of energy to neighboring systems, possible future interconnections with other systems, as well as the possible loss of load due to subsidized competitive public power projects.

Utility systems of today do not just grow at random. They must have a basic plan of evolution based on long-range planning, so that new capacity can conform physically and geographically to the growing pattern of the loads, and the maximum use can be derived from each installation and piece of equipment. It has been found convenient to study various possible schemes of development by means of a capacity development plan, in which the successive stages of required installation are plotted on the load curves, so that there will be at all times a minimum of excess capacity on the systems but at the same time sufficient firm hydro or supplementary steam capacity available to meet peak-load requirements and maintain adequate reliability of service. It is, of course, highly desirable for any system plan to be flexible and easily adaptable to changing conditions.

To take care of unexpected conditions, primary consideration should be given to the possibility of extending existing facilities. The rehabilitation of old and obsolete plants should be considered as a means of obtaining additional capacity at low cost. The possibility of increasing the output of existing plants by adding flashboards or new gates to the dam structure should also be investigated. If there are no existing plants that can be modernized or extended, a new hydro plant should then be considered and its cost compared with that of equivalent steam or Diesel generation.

It is essential to choose sites for hydro plants where there will be a minimum of capital expenditure initially and where future extensions can be made in successive stages. It is often possible to build only a partial development, by building a low dam or only the cofferdam for the future dam with, perhaps, a single unit capable of developing sufficient power under the reduced head. This will make possible at a later date the addition of economical intermediate and final stages of development. On some interconnected systems it is possible to augment existing hydro capacity simply by building upriver dams for storage—omitting the power house and generating machinery, which can later be added, when needed, at relatively low cost.

ECONOMICS OF LONG-RANGE PLAN MUST BE CONSIDERED

The capacity development plan should take into account the economics of the long-range plan as well as the justification for the immediate requirements. It is necessary to consider the cumulative capital investment required for the ultimate as well as the initial plan. The accumulated investment costs must be analyzed along with the accumulated fixed charges and production costs of the power, and these should be compared with the investment, fixed charges, and production costs of development by alternative methods of generation. This involves a year-by-year analysis of all possible combinations, and many different estimates of cost and operation.

It is now possible to discuss the capacity required for the immediate projected development. A study of the daily, monthly, and yearly load duration curves will provide a clear understanding of the requirements of the new plant, and is necessary to determine the method of development, and to decide whether the station should be built to full capacity initially, or constructed in stages. This study involves, too, selection of the number and size of the units—taking into account the number and size of units already in the system.

The development of a power project is analagous to the investment of funds in productive machinery in a manufacturing establishment. It must prove its value economically in the production of more salable units on a profitable basis or in the replacement of obsolete or less efficient equipment to produce output at a lower cost.

As in any business, the cash position of the company or ability to finance the project is of primary importance. Most private utility companies base capital investment in new plant facilities upon prospective earning power. Earning power has as its index the operating ratio, which is the relation between gross revenue and operating expenses. To maintain an attractive operating ratio requires that operating expenses be reduced to an absolute minimum in order to compensate for rising taxes, which steadily narrow the margin between cost and revenue. This can be accomplished in the new plant by adopting labor-saving devices, such as automatic control equipment, and installing simplified modern machinery requiring little maintenance and loss from outage.

The gross revenue to be obtained from the plant can be determined from the prospective rates to be charged for the power. Allowance should also be made for curtailed revenue resulting from possible power rate reductions based on past experience. The net revenue from operation is obtained by deducting all operating charges; and this net revenue, less fixed charges, should yield a fair return on the investment in the enterprise.

COMPARING ALTERNATIVE SOURCES OF POWER

After the economic aspects of the most favorable hydro program have been determined, comparison should be made with a program including steam or Diesel-generated energy, as well as purchased power from neighboring systems. To do this, energy obtained from other sources should be substituted in the load curves previously used for determining the proper capacity and method of development of the hydro plant. Alternate programs of generating stations, transmission line, and substation construction are then set up and new investment, annual fixed and production charges are determined. These costs are accumulated and tabulated for the period of study and a direct comparison made with the hydro program. It will be found that many attempts must be made before the true assumptions are obtained, and each source of new energy is on a comparative and equitable basis. These calculations will show the advantages and disadvantages of the hydro site when compared to steam, and they will also clearly point out the financial difficulties of building too extensively in the immediate future. A safe axiom to follow is that it is not advisable to overreach, particularly where fixed costs constitute a major part of the expenses, as conditions change too fast to be always safely forecast. During the period when the load is growing to a point where it can absorb the available capacity, the development will be accumulating a deficiency which it may never be able to overcome, except at the expense of the owner. Fixed charges on hydro plants constitute a large percentage of the annual costs—sometimes as much as 90 per cent—and they go on every day in the year, regardless of business activity.

Generally speaking, steam plants can be constructed at a lower cost per installed kilowatt than hydro plants but the costs of operation and maintenance are considerably higher. Of course steam plants have a distinct advantage in that they are more flexible and can be located nearer the load centers of the system.

Steam plant design has also reached a high degree of efficiency in equipment and economy in station layout. Recently there have been constructed plants of the semi-outdoor type in which expensive non-productive superstructure has been reduced to a minimum with a resulting saving in investment and fixed charges. A steam station of this type recently completed in the Southwest has the boilers and induced and forced-draft fans located outdoors, thereby eliminating the entire boiler-house superstructure. Other savings have resulted from superposition of high-pressure turbo-generators on older, low-pressure units, and from simplification of condensing works.

It is obvious, therefore, that hydro investment must be held at a minimum to keep pace with the economies possible in steam plants, and this must be accomplished also by the utmost simplification in design of station layout and by proper choice of large-size units. This precludes the building of monumental structures which may later be badly burdened by excessive fixed charges and requires that every feature of the design be either a direct producer or an aid to the production of salable energy. The outdoor type of hydro plant, in which expensive superstructure is reduced to a minimum by means of an outdoor gantry crane capable of handling outdoor transformer banks, generating units, and in some cases headgates and tailrace gates, is a typical example of the economies that can be obtained. Where conditions are favorable for outdoor installation and high-load-factor operation, the fixed and operating costs of such developments will frequently compare quite favorably with those of modern steam plants.

When field investigations and economic studies are finished, the engineer is then in a position to make his recommendations to the owner. At this stage the engineer must be able to visualize the proposed project, know that it is going to cost what he has estimated, and be able to assure the owner that with reasonable expectation over a period of years, the market will develop as indicated by the forecasts. Regardless of the difficulties that may develop during construction, it is the engineer's decisions and recommendations that determine the real cost of the development.

TRUE ENGINEERING CANNOT DISREGARD ECONOMICS

In conclusion, let us enumerate some of the things which the engineer should keep in mind when making his recommendations to the owner:

1. Remember that the owner is in business to make a reasonable return on the invested capital, and recommendations should be based on facts, not sentiment or political exigencies. A "hunch" may be an excellent indicator of what might be done, but it should not be followed until a basis of facts has been secured through the analysis of every point under consideration. Keep in mind that this venture is not for the purpose of establishing engineering or construction records, but is a business proposition, with its ever-present business risks.
2. Study the data on past load conditions, and with this as a basis consider the probable future market from every conceivable angle.
3. Put into the initial construction as little money as possible for future requirements, but leave the owner in position to extend the project when business warrants.
4. Be sure that the right choice and recommendations are made between hydro, steam, Diesel, and purchased capacity and energy.
5. Do not recommend capital expenditures and increased investment on equipment which will be used for low-load-factor operation to justify high efficiency, for while operation costs in such a situation are low, the fixed charges will be high.
6. Safety and adequacy of design are of prime importance in hydroelectric stations, as failure would cause a substantial loss of income and an enormous capital loss, as well as possibly a loss of life. However, designs should be simple, to keep expenditures at a minimum.

It will be recognized immediately that these are questions of economics, and true engineering cannot disregard economics. If it is disregarded, then the result is not engineering. The final recommendations of the engineer to the owner must be based upon a combination of sound engineering, economics, and business judgment.

Three Centuries of Structural Analysis

By S. C. Hollister

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Just three centuries ago was published the book by Galileo that laid the foundation for modern structural theory. In commemoration of the 300th anniversary of this event, Dean Hollister has prepared the accompanying paper tracing the subsequent development of the subject. His treatment, though necessarily brief, is comprehensive—and for the reader who seeks more detail he has provided a well-selected bibliography that should prove of great value. The present article is based on an address at the 1938 Fall Meeting of the Society.

THREE hundred years ago—in March 1638—there appeared from the press of the Elsivirs in Leyden, Holland, the world's first book on the strength of materials. It was written by the celebrated Galileo Galilei, based on experiments made some forty years earlier.

Galileo, it will be recalled, had previously published two books on his astronomical observations, in which he had strongly supported the Copernican system. For this work, at variance with the currently approved doctrine that the earth was the center of the universe, he had been brought before the Inquisition, forced to recant his support of the Copernican doctrine, and warned not to write further upon the subject. Perhaps, if he had not thus been stopped in his astronomical writings, he would not have given to the world his book called *The Two New Sciences,*[1] which founded the sciences of strength of materials and modern dynamics.

Nearly two thousand years before Galileo, we find, the Greeks were familiar with the principle of the lever, the pulley, the inclined plane, and the screw. Over those entire twenty centuries nothing further of interest was contributed in the development of modern structural engineering—not until the time of Galileo's early manhood, when we find Guido Ubaldo[2] explaining the pulley by the principle of what is now called "virtual velocities." One might thus fairly say that prior to Galileo, some simple tools of the builders were understood in principle, but that the parts of buildings themselves were unknown and unpredictable as to performance.

In 1586 a Hollander named Simon Stevin published, in the Flemish language, a book on statics[3] which for the first time presented the triangle of forces and explained the funicular polygon in the light of this triangle. It was not to be expected that such a meager beginning in the mechanics of materials would be followed by a rapid development. The means of experimental observation of the minute deformations of materials was to be developed long afterward. Until this was done, the field could be developed only by very crude observations.

Galileo appears not to have understood materials to be deformable. He undertook to deal with the cohesion between the particles that results in internal resistance, and ascribed its cause to a myriad of minute vacua existing in the interspaces between the particles. His contribution in this field consisted chiefly in stimulating philosophical discussion of the problem, which was not satisfactorily solved until long after his time.

He then attacked the problem of the cantilever beam and successfully solved it to the point where designs of cantilevers and simple beams could be made. He apparently had experimented with beams of stone or other brittle material, which on flexural rupture appears to demonstrate that the cross-section rotates about its compression edge. He thus concluded that the entire cross-section is subjected to tension, which he considered to be uniformly distributed. In all other respects his solution was correct.

In 1686, the French physicist, Mariotte, published as an appendix to a small book on *The Movement of Water*[4] the statement that a beam in bending was compressed on one side and stretched on the other. He could not observe how the deformation varied across the member, but assumed that there was a neutral surface on which neither stretching nor compressing took place and that it lay on the centroids of the cross-sections. On either side of this neutral surface he assumed the stresses to be uniformly distributed.

Eight years before this work, Robert Hook had published his famous principles of the spring balance in which he stated "the power of any spring is in the same proportion with the tension thereof."[5] This eventually became known as Hook's law of elastic action, in which deformation is proportional to the stress that produces it.

LEIBNIZ, THE BERNOULLIS, NEWTON, AND EULER

The German philosopher Leibniz had learned of the experiments of Mariotte and concluded[6] that Galileo's work was wrong in that the fibers are always subject to deformation before rupture. He said their resistance was proportional to their extension. This, in effect, is the application of Hook's law to flexure.

In 1705 James Bernoulli considered the work of Mariotte and concluded erroneously that the neutral surface need not be through the centroid of the cross-section—that it made no difference where it was located.[7] He succeeded, however, by aid of the calculus, in setting up the equation of the elastic line. This is the beginning of mechanical analysis, made possible by the calculus.

In 1717 Newton attacked the problem of the bond between the particles of a material.[8] In his day all sorts of occult qualities were being ascribed to the particles to account for cohesion. It was his opinion that attraction should not be considered as an occult quality but rather as due to some general laws of nature as yet undiscovered.

Ten years later Père Mazière[9] undertook to explain attraction by the theory of a fluid circulating between particles—suggesting that the centrifugal force of this fluid, by the Cartesian theory of vortices, held them together!

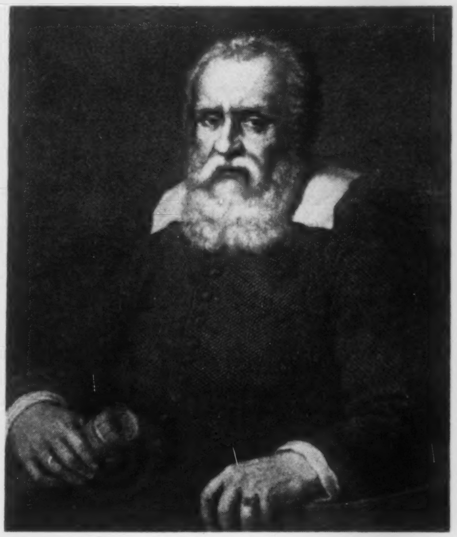
During all of this period, philosophers, physicists, and theologians were struggling with concepts of internal resistance, or stress, and the nature of energy, and were attempting to reconcile from their several viewpoints the hypotheses being advanced. It was clear to them all that an all-wise Nature would not waste her energy. From this theological concept there was gradually evolved what is now generally recognized as a natural law, namely, the conservation of energy.

During the years 1735–1743, Euler and Daniel Bernoulli (the nephew of Jacques Bernoulli), who were close friends, conducted a lively correspondence[10] relating to the flexure of elastic strips. In this correspondence

Bernoulli laid down the general principle that the potential energy of such a bent member must be a minimum. Based on this principle, Euler developed his celebrated treatise on the elastica[11] in which he solved the forms of elastic strips resulting from various end loadings. One special case of this treatment is the solution of the free-standing column upon which our modern theory of slender column action is based. He more fully developed this in 1757, in the form in which we now use it.[12]

It must be noted that at this stage of development the state of stress on the cross-section of the bent member was still undetermined. Euler simply states that the amount of the internal forces at any point is inversely proportional to the radius of curvature.

The stability of slender columns was further considered by Lagrange.[13] He points out that the stiffness of the column depends on the number of nodes in which it deflects. This concept is similar to that expressed in modern works on mechanics. He furthermore extended the theory for the incipient buckling of a column formed by a surface of revolution about its axis.



Galileo Galilei, Father of Modern Structural Analysis

We now come to a memoir presented by Coulomb to the Paris Academy in 1773[14] in which he assumes stress proportional to strain, and strain proportional to the distance from the neutral axis. By this hypothesis he is able to locate the neutral axis in a beam of purely elastic material.

In 1784 Coulomb published the results of his experiments on torsion of a right circular cylinder.[15] In these experiments he proved that the elastic twist of such a bar is proportional to the torque applied.

NOTABLE CONTRIBUTIONS OF COULOMB

Coulomb's memoir of 1773 is notable in three other respects for its fundamental contribution to structural engineering. For the first time the principle of failure by shear in brittle materials subjected to compression is presented. Also for the first time there is put forward a theory of earth pressure against retaining walls, whether arising from granular or cohesive materials, and this theory is still the accepted basis for design of retaining walls. Thirdly, this paper reiterates the principle that the proper curvature of an arch under a given system of loads is inversely the form of a funicular polygon carrying the same loads. (This principle appears to be due to the Scotch mathematician David Gregory.[16]) Coulomb then determines the proper slope of the faces of the voussoirs of the arch in order to prevent their sliding under the compressive action.

In 1807 Dr. Thomas Young published his course of lectures on *Natural Philosophy and Mechanical Arts.* In this work he gave his definition of an elastic constant, as follows:[17] "The modulus of the elasticity of any substance is a column of the same substance capable of producing a pressure on its base which is to the weight causing a certain degree of compression as the length of the substance is to the diminution of its length."

It will be seen that this is not in accordance with what we now call Young's modulus. It is, nevertheless, the starting point of a definite measure of the elasticity of materials.

In the same work Dr. Young undertook the discussion of cohesion and stated that at that time it was shrouded in great uncertainty, partly from the intricacy of the subject, and partly for want of sufficient experiments.

Until the early part of the nineteenth century very little was known concerning the behavior of various materials. Nearly all work done up to that time had been analytical. Müsschenbroek in 1729 tested beams of wood and a few of iron. He also determined by experiment that the resistance of slender columns of given size and end conditions is in the inverse ratio of the squares of their lengths. This agrees with Euler's theory published fifteen years later. Bülfinger had in the same year reported tests on beams in an attempt to test the beam theories of Galileo, Mariotte, and Leibniz. He was not, however, successful.

In 1798 P. S. Girard published the results of extensive experiments on wood beams. He concluded that Galileo might be right in his hypothesis for stone beams, and Mariotte might be right as regards wood beams. In any case he agreed with Bernoulli in the erroneous conclusion that the position of the neutral axis was indifferent.

In 1805 Robison prepared an article on "Strength of Materials" for the Encyclopedia Britannica. We find this noted writer on mechanics contemptuous of the findings of Euler, ignoring the theory of beams advanced by Coulomb, and adopting instead the imperfect hypothesis of Galileo. This article is typical of many English writings of the time. It reflects the unfortunate schism between English and continental scientists created by the Newton-Leibniz controversy, then a century old, concerning the authorship of the calculus.

In general we may say that prior to a century ago the net accomplishment of value to the modern engineer was the work on buckling of columns by Euler and Lagrange; and the remarkable paper by Coulomb in which he correctly located the neutral axis of a beam, founded the maximum shear theory, and established the pressures of earth against retaining walls. So little had been established concerning the properties of materials themselves that the findings to that date could be disregarded without serious loss.

The development of information concerning materials now proceeded in earnest. The first worth-while book on the subject related to the strength of timber and was written by Peter Barlow in 1817.[18] This was followed five years later by Tredgold's book on the strength of cast iron.[19] The two books gave much useful information concerning these materials—though both perpetuated to an astonishing degree the faulty analysis of earlier writers with apparently no knowledge of Coulomb's work.

At this time the construction of good roads had been undertaken on a large scale in both France and England, and the locomotive had just been invented. The great era of transportation development had begun. With it the need for bridges and other structures became of great practical importance.

As the era of transportation was getting under way, analytical developments of vast importance in structural analysis were being made. In 1819 Navier gave a complete analysis of the strength and deflection of beams.[20]

In 1823 he prepared the first analytical treatment of suspension bridges,[21] and in 1826 published the first edition of his *Lessons in Applied Mechanics*,[22] in which he treated the flexure of beams, the bending of columns under eccentric load, the theory of elastic arches, and the analysis of suspension bridges. In 1821 Navier had read his famous memoir,[23] which forms the true foundation of the modern theory of elastic solids. These writings by this one man form the basis on which modern structural and elastic theory rests.

It is strange that throughout the early development of trusses there was no method for their analysis. Practice far outran theory. It remained for a little-known instrument-maker of Utica, N.Y., to publish in 1847 the first correct analysis of a truss.[24] Its author, Squire Whipple, became one of America's leading bridge engineers during the following thirty years.

Progress in the development of analysis resulted in the gradual abandonment of wood and stone as the sole structural materials. One must here leave out of consideration those structures that are built largely by craftsmen for architectural effect. Stone arches were built more than two thousand years before their analysis was known. The first cast-iron bridge of importance was built in England in 1776 with a span of 100 ft. Thereafter many arches of this material were constructed in England and Wales. Limitations of casting and erection made their application less flexible until the development of trusses in which wrought iron was used for tension members.

With the rapid expansion of railroad construction after 1830 in England and America, the need for bridges that could be readily fabricated and erected stimulated the development of all forms of trusses. In those days the suspension bridge was never seriously considered for such service. Elaborately framed wooden bridges had been developed in Germany. In this country they had been developed as combinations of arches and trusses, analysis of which would be difficult or impossible even today.

In 1820 Ithiel Town, an architect of New Haven, invented the lattice truss that bore his name. This truss became the forerunner of the iron lattice truss and eventually of the plate girder. In 1840 William Howe invented his simple wood truss with wrought-iron vertical tension members. This became the popular truss for wood railroad bridges and is still to be found in regions where metal is scarce and timber bountiful.

By the close of the eighteenth century wrought iron had been used for several small structures, but it did not become important as a structural material until the beginning of the nineteenth century. In 1826 Thomas Telford completed his famous suspension bridge over Menai Straits in North Wales in which the entire suspension system was of wrought-iron eye-bars.[25] The channel span of the structure was 570 ft long, and it remained in service for 110 years. His design was made after actually measuring the pull in an eye-bar chain of full-scale span and sag, and by proportioning the bars to be stressed within the yield point. From this time wrought iron was frequently used in suspension and truss bridges. With the extension of railroads and the increased weight of their equipment, the need for stronger and stiffer bridges steadily grew. During the years from 1840 to 1890 the names of Whipple, Bollman, Fink, and Post stand out as developers of various systems of trusses.

During 1842 to 1848 Hodgkinson and Fairbairn made extensive experiments on the bending strength of tubes and plate girders.[26] The outcome was the construction in 1848 of the Conway Bridge over Menai Strait in North Wales, with a single span of 400 ft. This was followed in the next year by the Britannia Bridge over the same Straits, in which two of the spans are 460 ft each. This bridge, which carries a double-track railway, is still in service.

It was not until the end of the nineteenth century that an accurate analysis of plate girders was available.[27] Such analysis has not yet found its way into standard specifications for these members.

In 1857 Clapeyron published the "theorem of three moments" by which continuous beams could be analyzed.[28] The method of "fixed points" for analysis of such members was published by Mohr in 1868.[29] The method of "characteristic points" was given by Fidler[30] in 1883 and extended by Ostenfeld[31] in 1905.

By 1860 considerable interest was developing in graphical methods for the solution of structural frames. The principle of Stevin's triangle of forces was expanded by Varignon in his *Mechanics* of 1725. This was broadened into a complete treatment of framed structures by Culmann[32] in 1866 and further extended to statically indeterminate structures by the Ritters,[33] 1888–1906. Maxwell contributed the stress diagram for trusses in 1864.[34]

The method of sections and the principle of moments were first presented by A. Ritter[35] in 1863. It is by these methods that trusses are analyzed today.

It may fairly be said that the last seventy-five years constitute the modern period in structural development. During that time our modern data on materials have been developed. The range of available materials for

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structures has been vastly increased and improved. Also during that period the advanced theories of frame works and of elasticity, and most of the modern analysis of statically indeterminate structures, have been brought forward.

Two great works on mechanics exerted profound influence. The first of these was by Rankine, published in 1858 and continued through 19 editions to 1914. This great Scottish engineer made notable contributions in earth-pressure and column theories. The second work was A. Föppl's *Technical Mechanics*, in five volumes.

Methods for computing the deflection of trusses were developed by Maxwell[34] in 1864 and by Williot[36] in 1877. In 1868 Mohr set forth his deflection theory by the use of string polygons,[37] and Maxwell his principle of reciprocal deflections[34] in 1864. Ten years later Mohr developed the principle of virtual work.[38] These methods were greatly expanded in the writings of Müller-Breslau from 1886 on.[39]

The principle of least work, originally announced in 1858 by Menabrea,[40] was developed and given broad application by Castigliano in 1879.[41]

The method of slope-deflections has been used independently in various ways by Manderla[42] who employed it for secondary stresses in 1879; by Mohr[43] in 1892, also for secondary stresses; and by Maney in 1915 as a general method for the analysis of rectangular frameworks.[44]

In 1923 Ostenfeld published his method of deformations[45] as a general principle by which statically indeterminate structures may be analyzed.

The theory of the arch is generally founded on writings of Bresse, 1854[46]; Winkler,[47] and Ritter, 1906.[48]

The modern period also has developed the application of elasticity to an important degree in structural engineering.[49] Following Navier, the fundamental basis of elasticity was extended by Cauchy and Poisson. However, elasticity was actually brought into the structural field by the contributions of Lamé, St. Venant, and Clapeyron during the modern period. It has in recent years been widely extended and applied by Prandtl, the Föppls, Timoshenko, von Kármán, Ostenfeld, Nádai, Westergaard, and others. At the hands of these men many important problems in buckling, bending of plates, behavior of shells, and vibration have been considered and solved. It is not too much to say that at the present time theory has, in a large number of instances, far outrun practice in this field.

In the field of building construction the flat slab of reinforced concrete is an example of a new form of member made possible by the nature of the material. It has been the subject of much study, especially by Nádai, Galerkin, Slater, and Westergaard. The basic mechanics of other members of reinforced concrete has been developed by a number of investigators, notable among whom are Considère, Talbot, Hatt, Turneaure, and Withey.

Present-day structural engineering could not have come into being without the knowledge of the behavior of materials that has come during the modern period. During the 1860's, Wöhler and Fairbairn accomplished the initial work on fatigue of metals. During the 70's and 80's adequate machines for studying materials in tension, compression, and flexure were designed and brought into general use. Since then apparatus for studying many important properties of materials has been developed.

The first important work in America on the materials of construction was published in 1897 by J. B. Johnson. Conspicuous as sources of reliable information in this book are the early publications of the Watertown Arsenal, and the writings of Bauschinger, Tetmaker, Martens, and Considère. Of particular interest is a chapter on metallography, a field of study of materials established by Sorby about 1861.

With the spread of use of steel for structures in the nineties, the size of buildings and bridges increased. Cold-drawn iron wire had been used for suspension bridges since 1816, more especially by Chaley in France, and Ellet and Roebling in America. The Brooklyn Bridge was the first in which steel wire was used. But the construction of the steel cantilever bridge over the Firth of Forth at Edinburgh, with two spans of 1,710 ft, marked a new era for framed structures. Since then, further development of alloy steels has made possible the construction of longer spans, with modern heavy loading.

GALILEO'S GREAT WORK A MILESTONE

In review, one may say that modern structural analysis and mechanics of materials has been developed largely over the last 125 years. But the way had been carefully though slowly prepared by the earlier philosophers and experimenters. Those earlier accomplishments—attained without precedents and frequently in the midst of unsympathetic and gloomy surroundings—were of vital importance. Certainly to Galileo, who broke in method and in philosophy with all that went before, must go our gratitude and our admiration on this three-hundredth anniversary of the publication of his great work.

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Effects of Mississippi River Cut-Offs

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The program of Mississippi River channel stabilization described by General Ferguson in the November issue has been of measurable value to both navigation and flood control. Cairo has been brought more than a hundred river miles nearer the Gulf, and the mean depth at mean low water has increased by 10 per cent between Natchez and Vicksburg. Rating curves for various gages reflect a material increase in carrying capacity of the river in the past few years; and a study of the 1929 and 1937 floods shows that the former, should it recur under present conditions, would pass Arkansas City at a 10-ft lower stage than obtained in 1929. General Ferguson here gives detailed factual data on these changes. His paper is of special significance as the first detailed account released for publication by the man who instigated the cut-off program and originated the corrective dredging technique that has been such a potent factor in its success.

One of the first considerations that occurs to the average engineer with regard to the Mississippi River cut-offs is their effect on the river's length. Does the river quickly readjust itself following cut-offs and reestablish the length that existed prior to the cuts or is some new length established?

About five years of record are now available from which to observe the changes made since the recent cut-offs on the Mississippi River, though not all of the cuts have been in existence for this entire period. A low-water survey was made in 1932–1933, and a complete resurvey was obtained during the 1937 low water. By taking river lengths as measured along the center of the mean low-water channel from the 1932–1933 survey and comparing them with the lengths along the center line of the mean low-water channel as shown by the low-water survey of 1937, the actual changes obtained may be determined.

By comparing these changes with the shortenings made by the cut-offs, the trend of the river between cut-offs in the 4½-year interval since the first cut-off was opened will be shown. The river distance from Angola to Arkansas City (see Fig. 1, p. 726, November issue) measured 370.4 miles in 1933 before the cut-offs were made. (At Yucatan this measurement follows around the old bend, though the Yucatan Cut-Off, it will be recalled, formed naturally in 1929.) In 1937, measuring through the cut-offs, the distance between the same two points is only 250.45 miles, or a shortening of 119.95 miles. In this same reach the actual shortening accomplished by the cut-offs was only 111.46 miles. To this, improvement of secondary channels adds a shortening of 4.68 miles, making the total shortening in cuts and secondary channels 116.14 miles. Thus it is observed that the river itself has eliminated an additional 3.81 miles between Angola and Arkansas City during the 4½-year interval since the first cut-off was opened. Detailed comparison by reaches for individual cuts and the additional shortening accomplished by Caulk Cut, which is above Arkansas City, are shown in Table II.

Changes in River Cross-Section and Depth

The complete low-water survey obtained in 1937 has made possible a detailed comparison of channel areas with previous low-water years. Figure 22 compares graphically the 1937 areas with those of 1932–1933 before the cut-offs were opened. Both bank-full and mean low-water comparisons are shown, and the average change in reaches between cut-offs is given. This shows that in every reach between two cut-offs there has been an increase in both bank-full and mean low-water cross-section. The average increase in bank-full cross-section for all reaches between cut-offs from the head of Glasscock Cut-Off to Arkansas City was 15,700 sq ft, an increase of 7.6 per cent of the area over that of 1932–1933. At low water the average increase for the same reach was 9,600 sq ft or 16.3 per cent of the 1933 areas. The increase in bank-full area represents the removal of 500,000,000 cu yd of material from the bank-full cross-section between Glasscock Cut-Off and Arkansas City.

An analysis of the effect of the cut-offs on depths in the river between the cut-offs has been made by comparing mean depths in the 1932–1933 survey with those obtained in 1937. This comparison is summarized in Fig. 23.

This shows that from Glasscock Cut-Off to Arkansas City the mean depth at low water increased 0.7 ft, or 3.2 per cent, while at bank-full stage it increased 2.8 ft, or 6.6 per cent. A further significant fact may be noted by comparing the reach from Glasscock Cut-Off to Marshall Cut-Off with that from Marshall Cut Off to Arkansas City. In the lower reach the low-water mean

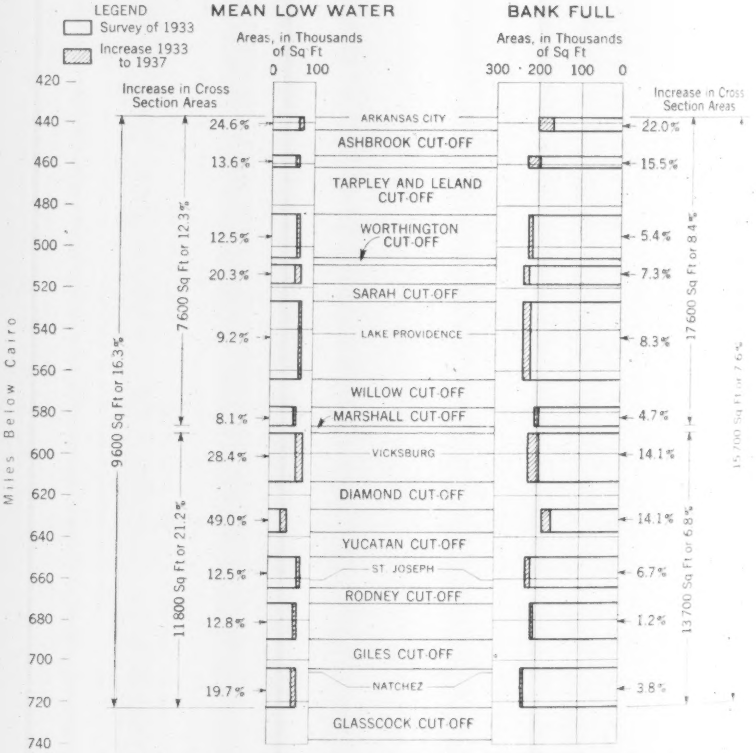

Fig. 22. Comparison of Areas, 1933 and 1937 Surveys, at Both Mean Low-Water and Bank-Full Stages

Table II. Comparison of Lengths, Mississippi River, 1932–1933 and 1937 Low Water
All Distances Measured Along Center Line of Mean Low Water Channel

Location	Distance Above Angola, in Miles		Shortening in Miles*		Reach
	1933	1937	Individual	Accumulated	
Angola	0.00	0.00			
			−0.36	−0.36	Angola to Glasscock
Ft. Glasscock Cut-Off	37.21	37.57			
			12.64	12.28	Glasscock Cut-Off
Hd. Glasscock Cut-Off	54.79	42.51			
			0.03	12.31	Glasscock to Natchez
Natchez Gage	71.80	59.49			
			−0.05	12.26	Natchez to Giles
Ft. Giles Cut-Off	73.49	61.23			
			12.03	24.29	Giles Cut-Off
Hd. Giles Cut-Off	88.43	64.14			
			−0.15	24.14	Giles to Rodney
Ft. Rodney Cut-Off	106.48	82.34			
			6.12	30.26	Rodney Cut-Off
Hd. Rodney Cut-Off	115.95	85.69			
			0.08	30.34	Rodney to Bondurant
Ft. Bondurant Towhead	120.44	90.10			
			0.47	30.81	Bondurant Chute
Hd. Bondurant Towhead	123.60	92.79			
			−0.02	30.79	Bondurant to Yucatan
Ft. Yucatan Cut-Off	133.24	102.45			
			11.34	42.13	Yucatan Cut-Off
Hd. Yucatan Cut-Off	146.66	104.53			
			0.25	42.38	Yucatan to Diamond
Ft. Diamond Cut-Off	160.51	118.13			
			13.37	55.75	Diamond Cut-Off
Hd. Diamond Cut-Off	176.18	120.43			
			−0.02	55.73	Diamond to Vicksburg
Vicksburg Bridge	186.36†	130.63†			
			0.17	55.90	Vicksburg to Marshall
Ft. Marshall Cut-Off	197.24	141.34			
			4.87	60.77	Marshall Cut-Off
Hd. Marshall Cut-Off	205.18	144.41			
			1.21	61.98	Marshall to Willow
Ft. Willow Cut-Off	215.95	153.97			
			8.41	70.39	Willow Cut-Off
Hd. Willow Cut-Off	229.04	158.65			
			0.98	71.37	Willow to Opossum Chute
Ft. Opossum Chute	262.90	191.53			
			2.36	73.73	Opossum Chute
Hd. Opossum Chute & Ft. Sarah Cut-Off	269.47	195.74			
			5.63	79.36	Sarah Cut-Off
Hd. Sarah Cut-Off & Ft. Cracraft Chute	278.25	198.89			
			1.85	81.21	Cracraft Chute
Hd. Cracraft Chute & Ft. Worthington Cut-Off	285.13	203.92			
			5.22	86.43	Worthington Cut-Off
Hd. Worthington Cut-Off	294.04	207.61			
			1.01	87.44	Worthington to Leland
Ft. Leland Cut-Off	318.62	231.18			
			10.19	97.63	Leland Cut-Off
Hd. Leland Cut-Off & Ft. Tarpley Cut-Off	330.07	232.44			
			9.37	107.00	Tarpley Cut-Off
Hd. Tarpley Cut-Off	342.87	235.87			
			0.22	107.22	Tarpley to Ashbrook
Ft. Ashbrook Cut-Off	348.73	241.51			
			12.27	119.49	AshbrookCut-Off
Hd. Ashbrook Cut-Off	362.56	243.07			
			0.46	119.95	Ashbrook to Arkansas
Arkansas City	370.40	250.45			
Lower End of Caulk Neck	16.59‡§	16.59§			
			16.33	136.28	Caulk Cut-Off
Upper End of Caulk Neck	35.26‡§	18.93§			
Mouth of Arkansas River	41.92‡§	25.59§			

* Minus sign indicates lengthening. † Through Racetrack Chute. ‡ Bendway distances measured in 1937 survey. § Distances above Arkansas City.

depth increased 2.2 ft, or 10.0 per cent, while in the upper reach it decreased 0.5 ft, or 2.2 per cent. At bank-full stage the mean depth from Glasscock to Marshall Cut-Off increased 4.4 ft, or 9.7 per cent, while from Marshall to Arkansas City it increased 1.8 ft, or 4.5 per cent. Thus it will be noted that in the upper reach the increase in mean depth at bank-full stage was accompanied by a decrease in mean depth at low water.

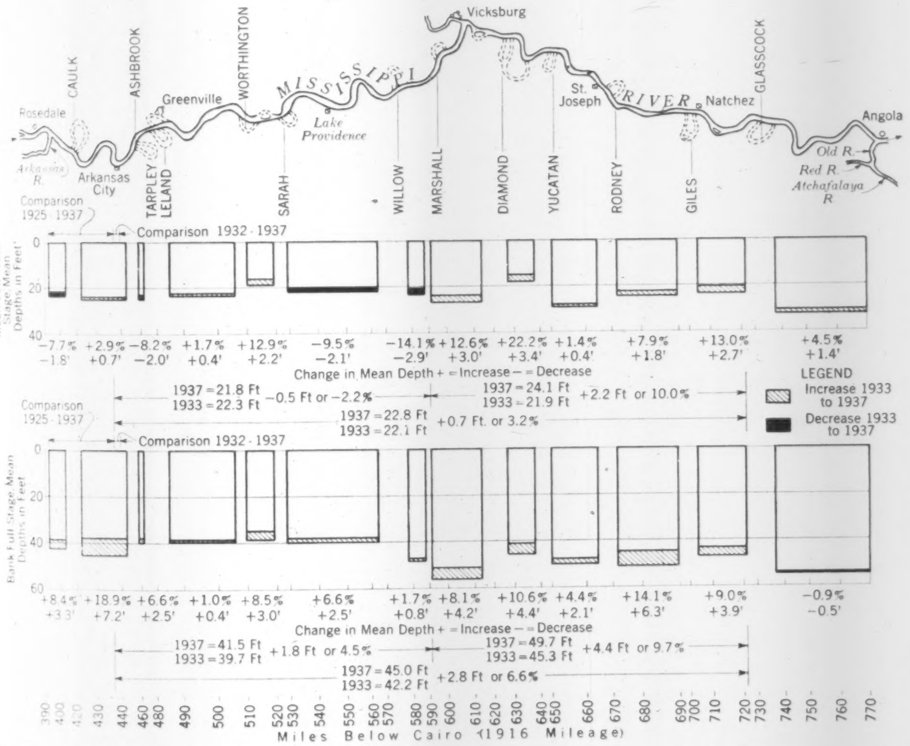

Fig. 23. Comparison of Depths, 1933 and 1937, Mean Low-Water and Bank-Full Stages
Both Comparisons Are Based on Cross-Sections in Approximately the Same Locations. They Refer Only to Reaches Between Cut-Offs

CHANGES IN RATING CURVES

Measurements of river flow at key points have been made both before and since the cut-off program was undertaken. A comparison of the measurements made in recent years with those obtained at the same points prior to the cut-off program shows the changes in the relation between river stage and volume of flow at these key localities. Figure 24 shows the stage-discharge relations at Arkansas City and at Vicksburg Bridge. From these curves it is apparent that the discharge at the crest of the 1937 flood was about 380,000 cu ft per sec greater at Arkansas City than in 1929 but the gage was 5 ft lower, which corresponds to a lowering of about 11 ft for equivalent flows. At Vicksburg the flow was 340,000 cu ft per sec greater, the gage 0.3 ft higher, and the lowering for equivalent flows from 4 to 5 ft.

COMPARISON OF RIVER SLOPES

Comparison of changes in slopes, in order to have significance, must be based on equivalent river flows or allowance must be made in the comparison for the difference in flow. Figure 25 shows the flow line of the 1937 flood crest compared with that of 1929 through-

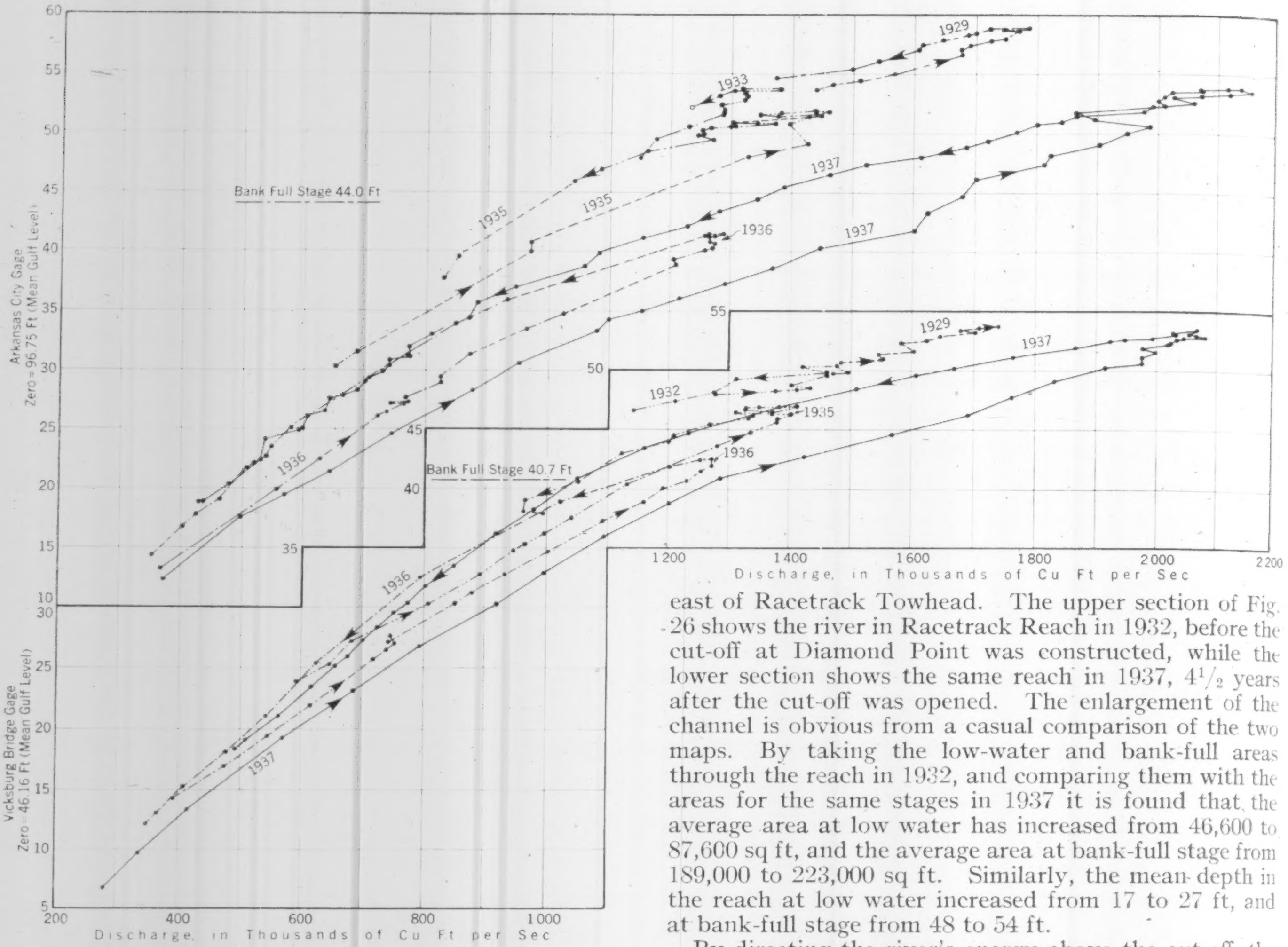

FIG. 24. CHANGES IN STAGE-DISCHARGE RELATIONS AT ARKANSAS CITY, ARKANSAS, AND AT VICKSBURG BRIDGE
Each Dot Indicates a Discharge Measurement. The Direction of the Arrows Indicates Rising and Falling Stages.

out the reach of the Mississippi River from the mouth of the Arkansas River to below Glasscock Cut-Off. In drawing conclusions from this comparison, allowance must be made for the difference in flood flow for the two years. Studies made allowing for these differences show a lowering, for equivalent flows equal to the crest of the 1929 flood, of from 10 to 12 ft at Arkansas City, from 4 to 6 ft at Vicksburg, and from 1 to 2 ft at Natchez.

CHANGES IN TYPICAL REACH BETWEEN CUT-OFFS

As a coordinate part of the cut-off plan, improvement of channels above and below the cut-offs has been undertaken by dredging and construction of sand fills. These operations served two purposes, namely, to improve the navigable channel and to assist the river in lowering its high-water stages as uniformly as possible. An appreciable stage lowering has been effected immediately above each cut-off, but this lowering would not have persisted upstream for any great distance without the aid of this "corrective" dredging.

Racetrack Reach in the Mississippi River, just below Vicksburg and immediately upstream from Diamond Point Cut-Off, is typical of this class of development. It includes the first shoal section above the cut and a split channel at Racetrack Towhead (see Fig. 26). Prior to 1930 the low-water channel had followed Reid Bedford Bend, but during the low water of that year it was established in the chute, or straight channel, to the east of Racetrack Towhead. The upper section of Fig. 26 shows the river in Racetrack Reach in 1932, before the cut-off at Diamond Point was constructed, while the lower section shows the same reach in 1937, 4½ years after the cut-off was opened. The enlargement of the channel is obvious from a casual comparison of the two maps. By taking the low-water and bank-full areas through the reach in 1932, and comparing them with the areas for the same stages in 1937 it is found that, the average area at low water has increased from 46,600 to 87,600 sq ft, and the average area at bank-full stage from 189,000 to 223,000 sq ft. Similarly, the mean depth in the reach at low water increased from 17 to 27 ft, and at bank-full stage from 48 to 54 ft.

By directing the river's energy above the cut-off, the crossing at the lower end of Racetrack Towhead has been made to deepen and enlarge; the chute has been enlarged; and the crossing at the upper end of the towhead has been deepened and enlarged. Approximately 11,700,000 cu yd of material were dredged to assist this development, the work consisting of dredging in the two crossings and of building sand fills at the entrance to the old bend and on the east bank opposite the head of Racetrack Towhead. The latter fill extended into the chute, but sufficient width was left to provide for a full-size river between the fill and the towhead. In addition to this dredging, agitation dredges worked on both crossings a total of 134 dredge days during 1933 and 1934.

Agitation dredging consists in running a specially equipped dredge at slow speed with suction drags raking the river bottom. All materials pumped to the surface are discharged overboard to be carried away by the current. In addition to the yardage so disposed of, large quantities of bottom materials are stirred up and, though not pumped to the surface, are also transported by the current. Advantage must be taken of river stages when the current is sufficiently strong to transport the loosened silt, sand, and gravel long distances. Agitation dredging is especially suited to deepening river bottoms where compaction of the bed materials effectively resists scour by natural processes.

The net result of all these operations in this locality has been the removal of 62,800,000 cu yd from the bank-full cross-section within the limits of the reach, of which 11,700,000 cu yd were removed by dredging. The remainder of the enlargement, amounting to 51,100,000 cu yd, therefore may be credited to the river itself.

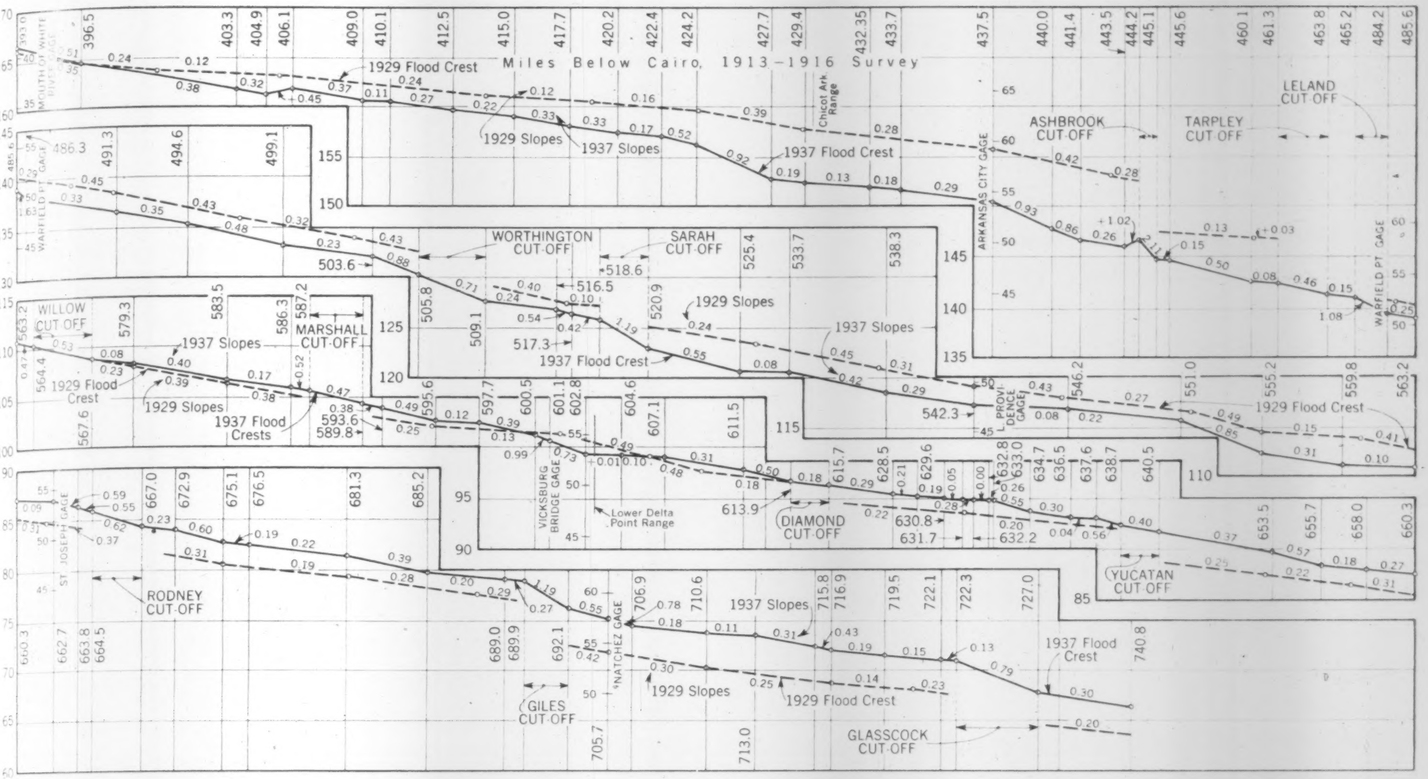

Fig. 25. Maximum Crest Stages of Mississippi River, from Mouth of White River to Below Glasscock Cut Off for Floods of May–June 1929 and February 1937

Profiles Were Plotted from Highest Observed Gage Readings and Do Not Represent Instantaneous Slopes. Solid Vertical Lines Represent Gages; Dotted Vertical Lines Indicate the Upper and Lower Limits of Cut-Offs. Numbers on These Lines Give River Mileage Below Cairo by the 1913–1916 Survey. Gaps in the 1929 Profile Are Shown Where River Has Been Shortened by Cut-Offs Made Since 1933. Slopes Between Gages Are Indicated on Each Profile in Feet per Mile; the 1929 Slopes Were Computed from River Mileage as Published in 1929, While the 1937 Slopes Were Computed from River Mileage Scaled in 1937 Through the Cut-Offs. In Comparing Profiles, Note That the Maximum Discharge at Chicot, Ark., Range Was 1,790,000 Cu Ft per Sec in 1929 and 2,160,000 in 1937; at Lower Delta Point Range, It Was 1,740,000 Cu Ft per Sec in 1929 and 2,060,000 in 1937

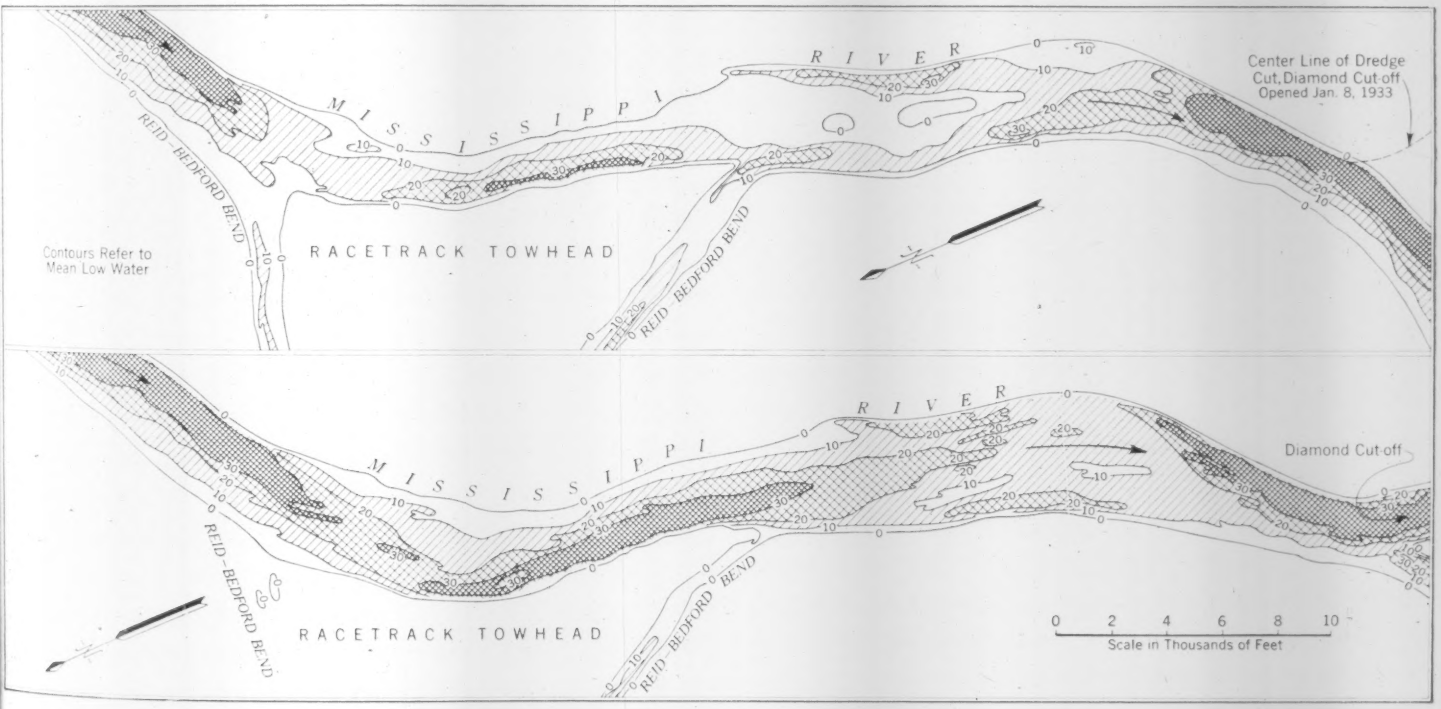
Mississippi River
Center Line of Dredge Cut, Diamond Cut-off Opened Jan. 8, 1933
Reid-Bedford Bend
Racetrack Towhead
Contours Refer to Mean Low Water
Diamond Cut-off
0 2 4 6 8 10
Scale in Thousands of Feet

Fig. 26. Channel Improvement Above Diamond Cut-Off

Upper Map Shows Channel Depths at Low Water in 1932 (September–November) and Lower Map Shows Channel Depths at Low Water in 1937 (October)

Southern New York Flood Control Project

Variety of Works Required to Protect Cities of Upper Susquehanna Basin; Models Aid Design

By GEORGE J. NOLD

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RESERVOIRS and channel works to reduce flood damage along the Upper Susquehanna River and its tributaries are now being planned and built by the Corps of Engineers. Major Nold here reviews the general problem, and the progress to date. Many of the investigations involve the use of hydraulic models, and much of the present article is given over to a discussion of two examples of such research. The full paper, of which this is an abridgment, was on the program of the Waterways Division at the Society's 1938 Fall Meeting.

THE Southern New York Flood Control Project covers the 7,500-sq mile drainage basin of the Susquehanna River above Athens, Pa. (Fig. 1). The area is part of the Allegheny Plateau, and its main valleys are deeply incised and usually a mile or more wide. The small tributaries descend from the uplands to the main valleys, and most of them carry large amounts of debris during floods.

In 1930, the population of the basin exceeded 500,000. One-half of the inhabitants live in 18 cities with populations exceeding 2,500. All of these cities are located on major rivers, and all but one are subject to inundation from these rivers. In addition, within the limits of 14 of them, one or more troublesome creeks empty into the major streams. Outside the cities, floods may seriously affect transportation, as the railroads and highways quite generally parallel the main streams.

Severe storms over the whole area have been rare, but local thunderstorms relatively frequent. Within nine months in 1935 and 1936, there were two major floods. The flood of July 1935, resulting from intense thunderstorms, caused more severe damage in the headwaters and tributary areas than along the main streams. The average precipitation over the area during the five days of this storm was between 6 and 8 in., of which approximately 80 per cent fell in 12 hours. At one locality, a maximum of 14 in. was recorded during 36 hours. The flood of March 1936 resulted from a heavy rain on an accumulated snow cover under conditions conducive to high runoff, producing greater damage along the Chemung and Susquehanna rivers than in the headwater areas. From 3 to 5 in. of precipitation were recorded, and it is estimated that an additional 3 in. of runoff resulted from melting snow. Preliminary reports gave estimates of $16,700,000 for the July 1935 flood, and $3,000,000 for the March 1936 flood, as the direct damage in the basin.

Following the 1935 flood, the Corps of Engineers was authorized to conduct an investigation of the flood situation in the area, and to recommend to Congress a means of preventing similar disasters. The work was assigned to the First New York District, under the jurisdiction of the North Atlantic Division. The data developed in this investigation formed the basis for the legislative action authorizing the Southern New York and Eastern Pennsylvania Flood Control Project. The preliminary work on the project was started by the First New York District. In July 1937 a new district, with headquarters in Binghamton, N.Y., was established, under which the work is being continued.

Because of the need of providing work for the unemployed in the region, construction of certain projects adaptable to the use of relief labor was authorized. These included channel improvement works at Avoca, Lisle, Oxford, Painted Post, and Upper and Lower Hornell, N.Y. The Binghamton District, since its formation, has completed these projects by hired labor, and designed and let contracts for the construction of two flood control dams for the protection of localities in southern New York.

GOOD RESERVOIR SITES ARE FEW

The nature of this drainage basin is such that it requires a solution of the flood problem unlike the solutions for certain other basins where plans of improvement have been carried out or are being prepared. Good reservoir sites are rare and it is hard to find locations for emergency spillways. The hydraulically less efficient side-channel type of spillway is often the only feasible structure. Large reservoirs on the main streams would interfere with existing culture, and headwater reservoirs would in general be too far from the centers where damage occurs to provide appreciable flood reduction. Local improvements are frequently complicated by small, flashy streams.

A total of 120 reservoir sites have been investigated, but few of these control a sufficient drainage area, provide adequate storage capacity, and have satisfactory foundation conditions to permit their construction at a

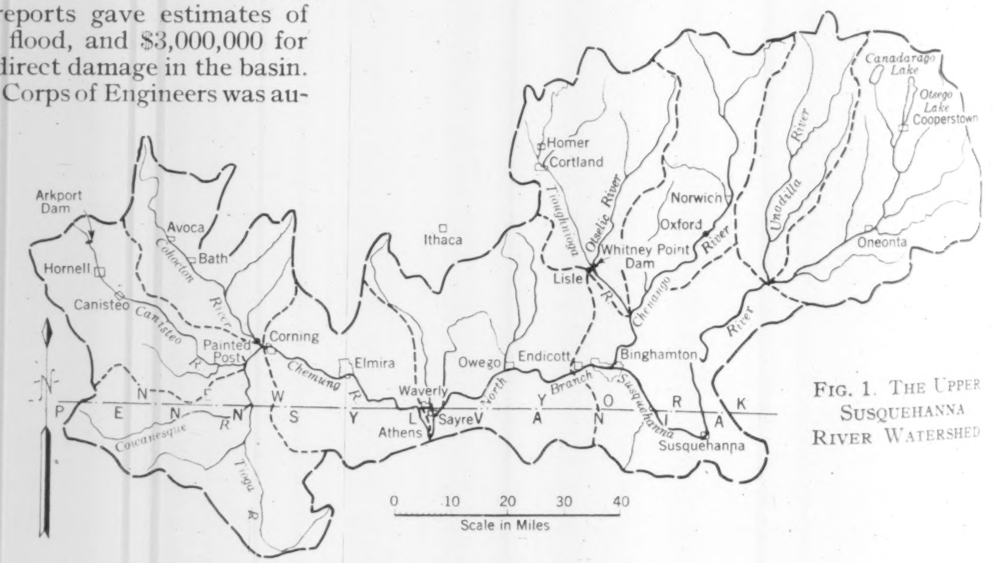

FIG. 1. THE UPPER SUSQUEHANNA RIVER WATERSHED

cost commensurate with their beneficial effects. Studies of channel improvements are being made at centers subject to flood damage. In some localities the present restricted condition of channels makes the combination of reservoirs and local improvements the cheapest method of protection.

HYDRAULIC MODEL STUDIES CONDUCTED

The Binghamton District is using hydraulic model studies in the design of flood control works. Tests on the Chenango River channel in Binghamton and the Arkport Reservoir spillway are nearly completed, and a brief report of them may be of interest.

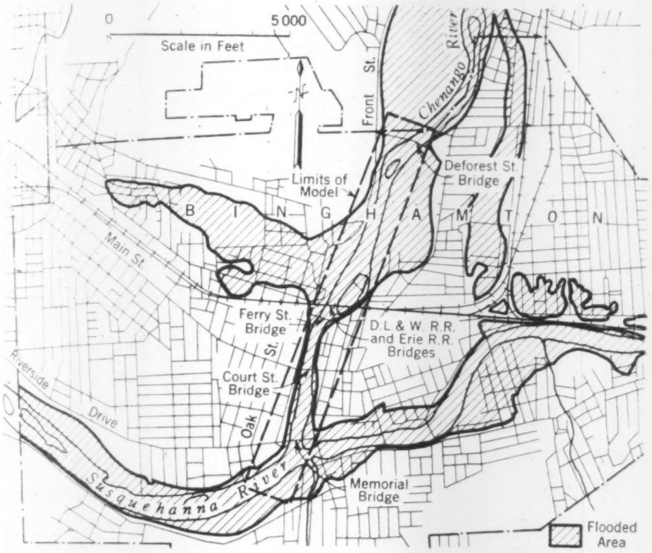

Fig. 2. Binghamton, N.Y., Showing Maximum Area Flooded in 1935 and 1936, and Area Included in Hydraulic Model

The condition of the Chenango River channel through Binghamton makes its improvement necessarily a part of any plan to provide flood protection for the city. As shown in Fig. 2, the model was made to represent the Chenango River channel for about 10,000 ft above its junction with the Susquehanna River. In this reach, the channel follows a fairly straight alinement, varies in width from 800 to 300 ft, and is crossed by four highway and two railroad bridges.

Large industrial and residential areas along the river are inundated when the normal flood stage is slightly exceeded. The flood of July 1935, which was particularly severe on the Chenango River, resulted in a peak discharge of 87,000 cu ft per sec. In March 1936, the peak discharge was approximately half that of the previous year, but an exceedingly high stage was caused by coincidence of the peak flows on the Chenango and Susquehanna rivers.

It was not desired to rely entirely on hydraulic computations, using the few known flood profiles of the Chenango River through the city. The results were particularly uncertain for the reach affected by the two railroad bridges, for the bad alinement of piers and abutments and the relation of bridge openings did not permit a sufficiently accurate analytical treatment of the flow. Moreover, the known flow lines were affected by failure of the old Ferry Street bridge during the 1935 flood, and by construction operations on the new structure at that site in 1936. Accordingly, the hydraulic model was selected as the most practical method of clarifying the flow conditions in the existing channel and furnishing the essential hydraulic data for proposed improvements.

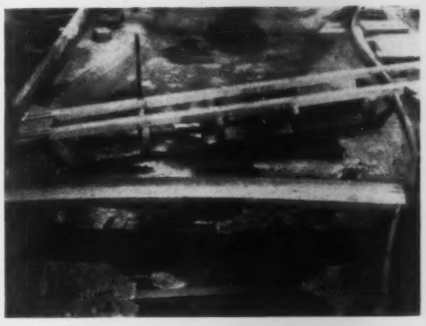

Fig. 3. Part of Chenango River Model, Showing One of the Channel Improvements Tested

Dotted Line at Left, Upstream from Bridges, Indicates Location of Present Wall. In the Model It Has Beee Set Back to Provide Additional Channel Cross-Section

The Hydraulic Laboratory at Cornell University, in Ithaca, N.Y., provided adequate facilities for the model investigation. The dimensions of the 16-ft canal permitted the use of a horizontal scale of 1:75 for the model. This scale was found to be satisfactory, since scour and movement of material were not a part of the investigation and a fixed-bed model could be used. Slight distortion of the vertical scale was considered, but was not used, as with careful measurements the desired accuracy was obtainable on the simpler undistorted model.

The model was of concrete, finished with a wooden float to represent the approximate roughness of the prototype. It was planned to "adjust" this roughness, if necessary. Provisions were made to facilitate changing those parts of the model in which channel improvements were anticipated, and the effect of improvements was determined by observing the changes in water surface on the 26 piezometers located along the model channel. A part of the model is shown in Fig. 3.

In order to check the similarity of model and prototype, actual observed flow lines were compared with those obtained in the model. The maximum observed deviation between actual and model profiles was found to be within the limit of accuracy of the model, indicating that the model roughness had been correctly selected and was not in need of adjustment. Since the known flow lines were affected by the changes at the Ferry Street bridge site, a series of tests over a wide range of flood discharges and Susquehanna River stages was conducted to furnish the flow lines for the existing channel.

Replacement of the badly alined piers of the railroad bridges by more efficient shapes showed a surprisingly small reduction in stages. Various improvements of the channel through the Ferry Street and railroad bridges and between Ferry and Court streets were then investigated. Channel enlargement between the Ferry and Court Street bridges was found to give a stage re-

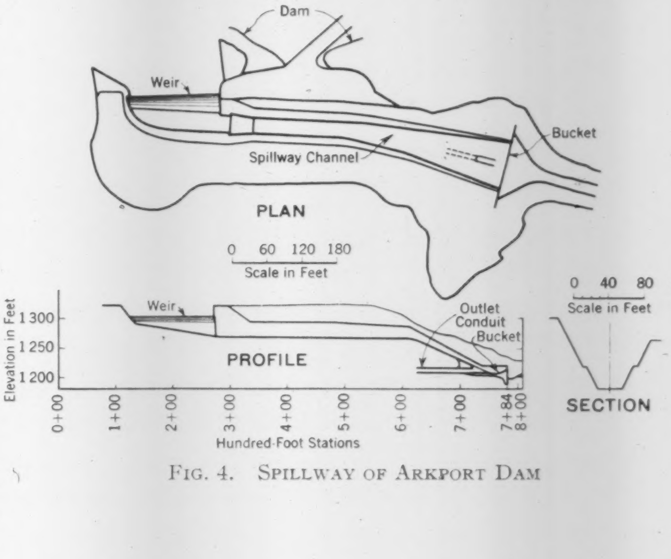

Fig. 4. Spillway of Arkport Dam

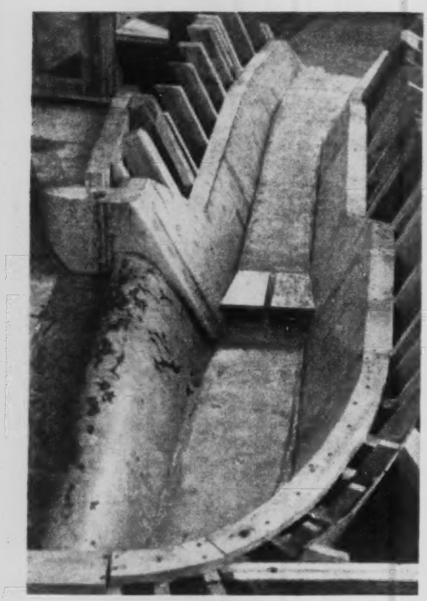

FIG. 5. THE SIDE-CHANNEL SPILLWAY MODEL

duction of 0.5 ft for average conditions. An attempt to improve the efficiency of the new Ferry Street bridge resulted in no apparent stage reduction. On the other hand, alterations in the railroad structures to increase the bridge openings, including setting back the west abutments to provide better channel alinement, gained an additional reduction of 0.5 ft.

These studies are a typical example of the application of models to a complex hydraulic problem. The results furnish the information required for the best design of the channel improvement, but since the tests pertain only to this particular problem, they are of little general value.

Arkport Reservoir is part of the work for flood protection at Hornell, N.Y. The dam is a rolled earth-fill embankment having a height of 100 ft and a length of 1,200 ft. Its reservoir controls a drainage area of 31 sq miles and has a storage capacity of 8,000 acre-ft.

Discharge facilities comprise a side-channel spillway and an outlet conduit, both discharging into a single flip bucket (Fig. 4). The size of the side-channel spillway was determined by the method developed by Julian Hinds, M. Am. Soc. C.E. ("Side Channel Spillways," TRANSACTIONS of the American Society of Civil Engineers, Vol. 89, 1926, page 881), for a required discharge of 29,100 cu ft per sec under a head of 13 ft. A control sill was placed in the throat section of the spillway to stabilize flow conditions in the side channel and to minimize disturbances in the race channel. The shape of the ogee section was developed for a head of only 10 ft, to take advantage of greater discharge coefficients for the largest flows.

The primary purpose of the model investigation was to develop the shape of the flip bucket and to study the scouring action of the sheet of water. In addition to this, the model furnished a means of observing the performance of the side-channel spillway and permitted comparative studies of possible improvements in the design. The model studies were performed at the District's Soils Laboratory at Ithaca, N.Y. A scale of 1:32 was selected, making the best use of available space and water supply.

In Fig. 5 is shown the model of the side-channel spillway and bucket. The model was built of sheet metal to simulate the surface roughness of the prototype structure. The scour tests gave comparative results only. In the preliminary tests, the valley bottom below the bucket was represented by fine gravel, and in the final tests the good rock surface in the valley was simulated in the model and fine sand was used for the overburden.

The spillway was tested for flows well over the design capacity. The side-channel spillway, as designed, was found to be satisfactory, but an attempt was made to improve its performance. Elimination of the control sill or changing its height resulted in less satisfactory conditions. Narrowing the side channel by 7 ft and the race channel by 5 ft showed smoother hydraulic action, but reduced the ultimate capacity by completely submerging the upper end of the weir (Fig. 6). A slight saving in cost possibly could have been accomplished with the narrowed channel, but since the original design permitted a greater discharge, above the design limit, and gave a larger factor of safety, it was adopted for construction.

It was found that the original bucket design resulted in considerable scour, extending to the toe of the dam. Lowering the elevation of the tailwater aggravated this condition. A slight improvement was secured both by raising the tailwater elevation and by filling the notches originally provided in the lip of the bucket.

To observe performance of the bucket for various angles, the simple expedient of inserting a piece of sheet metal, which was hinged to the lower end of the race channel, was used. A steeper inclination of the bucket was found to give better results. Preliminary tests were made with angles of 30, 45, and 60 deg. For an angle of 45 deg, the amount of scour was greatly diminished and it occurred the farthest from the toe of the dam. The bucket was redesigned in accordance with this information and was tested for the complete range of outlet and spillway flows. A comparison of the original and final bucket design is given in Fig. 7.

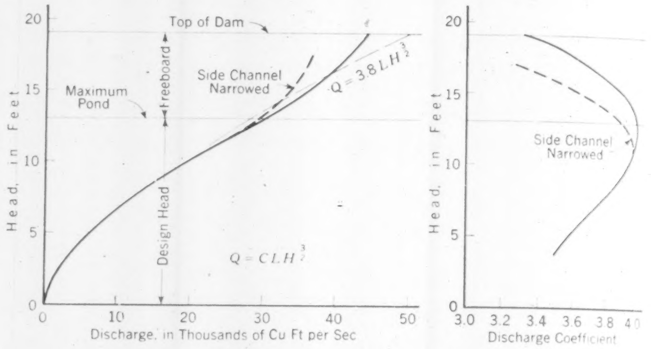

FIG. 6. SPILLWAY DISCHARGE RATING AND COEFFICIENT CURVES FOR ARKPORT DAM

The fact that the original design of the side-channel spillway was found to be satisfactory proved the reliability of the design methods. The performance of the adopted flip bucket, as demonstrated by the model, assures the safety of the dam for all anticipated floods.

This paper was prepared by the personnel of the U. S. Engineer Office, Binghamton, N.Y. The laboratory tests of the Chenango River model were conducted by E. W. Schoder, M. Am. Soc. C.E., Professor of Experimental Hydraulics, Cornell University, under the direction of the District Engineer. The spillway model tests and studies were conducted under the direction of Paul H. Jaenichen, senior engineer, of the Binghamton District.

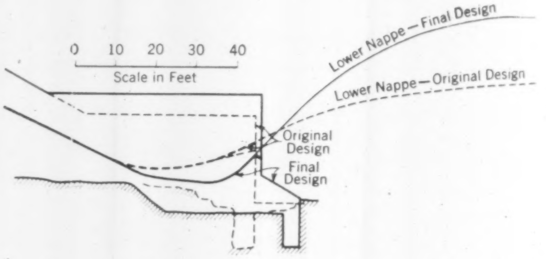

FIG. 7. BUCKET OF SPILLWAY AT ARKPORT DAM, SHOWING ORIGINAL DESIGN AND MODIFICATIONS MADE AFTER MODEL STUDY

How Rochester Handles Its Traffic Problem

Comprehensive Traffic Surveys and Progressive Control Methods Described

FROM A PAPER PRESENTED BEFORE THE CITY PLANNING DIVISION AT THE SOCIETY'S 1938 FALL MEETING

By LEON R. BROWN

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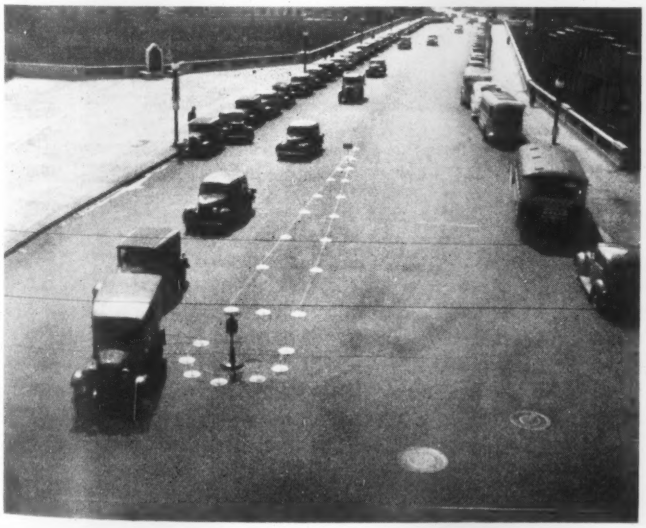
WHEN the Traffic Committee of the Rochester Engineering Society was organized about 1926, one of its first acts was to make a motion picture entitled "Traffic in Rochester." This film had a profound effect—even though it showed scenes with which the citizens of the city were thoroughly familiar. It was first presented at a large mass meeting sponsored by the Committee, and did much to make the citizens and the various civic organizations traffic-minded.

In 1927, with the aid of 2,000 Boy Scouts, the Committee made a so-called traffic survey, and since then this survey has been repeated and enlarged upon each year. It furnishes much of the data upon which traffic control in Rochester has been based. One feature of the annual survey has been a traffic count of all vehicles entering and leaving the central business district by each street, by half-hour periods. It also classifies the vehicles by types, and at times has shown the number of passengers in each. We have been told that this material, secured annually over a period of 11 years, with other data we have collected, forms one of the most complete traffic records available in any city.

Other data we have secured include annual traffic counts on bridges, annual parking surveys, city-line and intermediate cordon counts, traffic counts at all traffic signals, traffic flow diagrams, speed tests, and many miscellaneous items such as sex of drivers, boulevard stop observances, drivers making hand signals, how closely vehicles keep near curbs, and the time lost at boulevard stops.

Our cordon counts of cars entering and leaving the central traffic district, taken at exactly the same points for 11 years, indicate a gradual increase in traffic amounting to 27 per cent, or 2.7 per cent a year, which almost exactly equals the growth of automobile registration in the county during the same period. On certain streets traffic has increased nearly three times, while on others it has been cut nearly in half during the 11 years.



PROPOSED CHANNELIZATION IDEAS BEING TRIED OUT AT SOUTH AVENUE AND BROAD STREET, ROCHESTER

As previously mentioned, all the counts have been taken by half-hour periods so that we know just when traffic peaks occur and just how much they exceed the low points. The evening peak of the outbound rush-hour traffic is now about double that of the forenoon average. Ten years ago this evening outbound peak was nearly three times that of the forenoon average. Inbound traffic is much more uniform throughout the day.

The number of passengers in each passenger automobile was found by several different determinations to be about 1.6, which corresponds closely with similar determinations in other cities.

There has been considerable discussion as to which are the better drivers—men or women. Some claim the women are, since they have less accidents. Others claim that women are less exposed to accidents since they drive less mileage. Until 1932 there were no reliable data available except as to the number of registered women drivers and this does not measure the hazard. In 1932 we counted the women drivers in nearly 200,000 cars on various streets of Rochester. The percentage varied from a maximum of 15 per cent on some streets to a minimum of 6 per cent on others. The average was 7.4 per cent. This corresponded very closely with the percentage of women drivers involved in accidents.

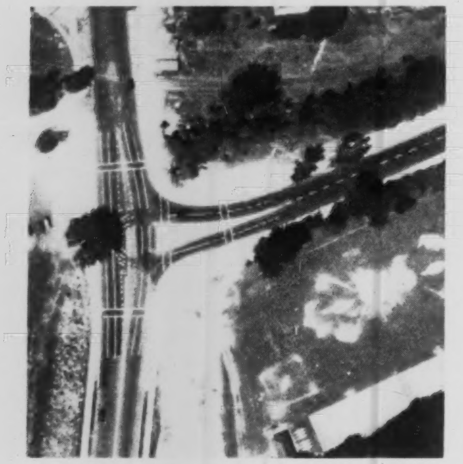
ANNUAL PARKING SURVEY YIELDS INTERESTING DATA

An important part of the annual traffic survey in Rochester consists of the parking survey. At the same time each year all the cars parked both in the streets and in private parking stations in the central business district are counted, as well as the vacant spaces. The license numbers of all cars are taken simultaneously and again an hour later. In this way all parking violations are discovered, including most time-limit parking.

The results have been interesting. I don't suppose they are any different from what they would be in other cities without parking meters. In all our surveys more than 50 per cent of all the cars parked in the streets were violating some parking rule. Other facts of interest are these: The capacity of the private stations and garages is three times that of the public streets. There have always been enough empty spaces in private stations to more than accommodate all the illegally parked cars and usually enough to accommodate all the cars parked in the streets. Of course this applies only to the central business district. The capacity of private stations has about doubled during the past ten years.

We have counted and classified by half-hour periods and by types of vehicles all the traffic crossing the various bridges over the Genesee River. The records go back to 1910 and form interesting and informative data. From these may be determined the need for new bridges and many other things relating to Rochester's traffic problem.

At nearly every intersection where traffic signals have been installed we have counted the traffic to determine the necessity for signals and their timing to fit the cross traffic. At many intersections extremely difficult to control by signals we have made traffic-flow diagrams that show how many of each of all the possible turning movements are made during one day.



TRAFFIC LANES AND CHANNELIZATION AT JUNCTION OF PLYMOUTH AND ELMWOOD AVENUES, GENESEE VALLEY PARK, ROCHESTER

We have made checks to determine to what extent Rochester motorists obey traffic laws in making boulevard stops and in giving hand signals. The results show that only 41 per cent of the drivers make full stops; 29 per cent slow down; and 36 per cent do not stop or slow down more than is necessary to make the turn. Our observations indicate that 55 per cent of Rochester autoists make no signals when turning left, and a still greater percentage make no signals when turning right.

One driving habit that is conducive to accidents and causes congestion is driving in the center of city streets when there is space nearer the curb. We made a determination in Rochester—the only one I know of—as to how far from the curb people drive when they could drive near the curb. Our city ordinance requires drivers at all speeds to drive "as near the right hand curb as practicable except when passing or getting into a position to turn left." A determination showed that 92 per cent drove with their nearest wheel over 5 ft from the curb—thus occupying two traffic lanes. The streets were 40 ft in width where the determinations were made.

We also determined the percentage of drivers making turns from wrong lanes; 3 per cent made right-hand turns from left-hand lanes, and 6 per cent made left-hand turns from right-hand lanes.

A street efficiency test made on Main Street showed that 11,000 automobiles, comprising 75 per cent of the traffic, carried 40 per cent of the passengers, while 672 street cars and buses comprising 5 per cent of the traffic carried 60 per cent of the passengers.

Every year we have made counts of pedestrians on both sides of the streets and in both directions at all the important downtown points. It is interesting to watch the changing trends and to see how weather affects pedestrian traffic.

SPEED CHECKS MADE TO MEASURE CONGESTION

A measure of congestion in a street is not the number of vehicles using the street but the speed at which they can progress along it. To determine this condition in downtown Rochester we used two methods—one to find the average speed in the district and the other to find the minimum, maximum, and average speeds on different sections of various streets. This latter method was also used on arterial highways. The average speed in the business district was determined by driving for one hour each day over the same prescribed route. The test car passed the same number of cars as passed it. The average speed, including delays at signals, was about 9 miles per hr.

Extensive speed checks were made by a simple method we originated. Over thoroughfares two or three miles in length cars were timed simultaneously at several points. The data were collected by a group of three men at each location where a check was wanted. One man read aloud the time every 5 sec., another read aloud the last three numbers on the license plates of cars as they left the intersection, and the third recorded the numbers on a form in the space opposite the proper second. Watches were compared before and after the tests. When the data on the forms were compared, the course of a car could be easily followed, and the distances being known, the exact speed through each section could be computed.

On one section of East Avenue in Rochester the average speed in 1935 was found to be only 5 miles per hr. After elimination of parking in a bottleneck, this was increased to 18 miles per hour in 1936.

During the past year rapid progress has been made in facilitating traffic. We have some new street lighting, a traffic circle or two, and are doing considerable channelization. The greatest forward step was taken when parking was eliminated entirely during the day on the important business streets. Few cities have had the courage to attempt such progressive action.

The best engineering in the world, however, will not relieve traffic congestion or make traffic safe if there is a lack of enforcement. In Rochester we have adopted a non-fixable traffic tag which is a great success, but it applies only to minor violations. Our weak spot is lack of enforcement of the more serious moving violations. It is the consensus of opinion that this is not due to the police, but to the lack of a traffic court. Five city judges, all having different ideas on the subject, have been handling traffic cases. Small fines and suspended sentences have been the rule, and the police apparently considered it needless to risk their lives to catch a speeder. Recently intensive newspaper publicity has changed the picture considerably and there are now fewer suspended sentences, but enforcement is still weak.

METHOD OF ENCOURAGING PEDESTRIANS TO USE CROSSWALKS LEADING TO STREET-CAR LOADING ZONES—MAIN STREET, ROCHESTER

The future looks bright as regards traffic and accident records. With a Citizens' Advisory Traffic Committee doing active work, with a live accident investigation department, with an engineer devoting full time to remedying traffic conditions, and with a modern traffic ordinance about to be adopted, there should be still further improvement in conditions of which we are already proud.

ENGINEERS' NOTEBOOK

This department, designed to contain ingenious suggestions and practical data from engineers both young and old, should prove helpful in the solution of many troublesome problems. Reprints of the complete department, 8½ by 11 in., suitable for binding in loose-leaf style, are available each month at 15 cents a copy.

The Fixed-Point Theory for Continuous Beams with Elastic Supports

By Odd Albert, Assoc. M. Am. Soc. C.E.

Asssistant Professor in Civil Engineering, Newark College of Engineering, Newark, N.J.

Several methods for designing continuous beams have been developed. It is the belief of the author that of these, the Culmann method, as published by Dr. W. Richter in *Anwendungen der Graphischen Statik* (4 vols., 1888–1906), is most suitable for a variety of conditions and is also easiest to use.

In 1933 the author published an article in *Engineering News-Record* with the title "Continuous Beam Design by the Fixed Point Theory." However, that article dealt only with fixed supports, which had no influence on the bending moments. The present article will deal with elastic supports, and will show how the fixed point theory can easily be applied to this condition.

The design of a continuous beam depends upon the combined effect of the loading, and of the relation of the various members to each other. Culmann succeeded in separating these effects, thereby making each effect statically determinate. The effect of the various members on the member under consideration is expressed by the "fixed points," which can be determined for a continuous beam on elastic supports with complete disregard of the loading. The effect of the loading, on the other hand, is expressed by the "cross-lines," which can be constructed as functions of the loaded span considered as a single beam freely supported.

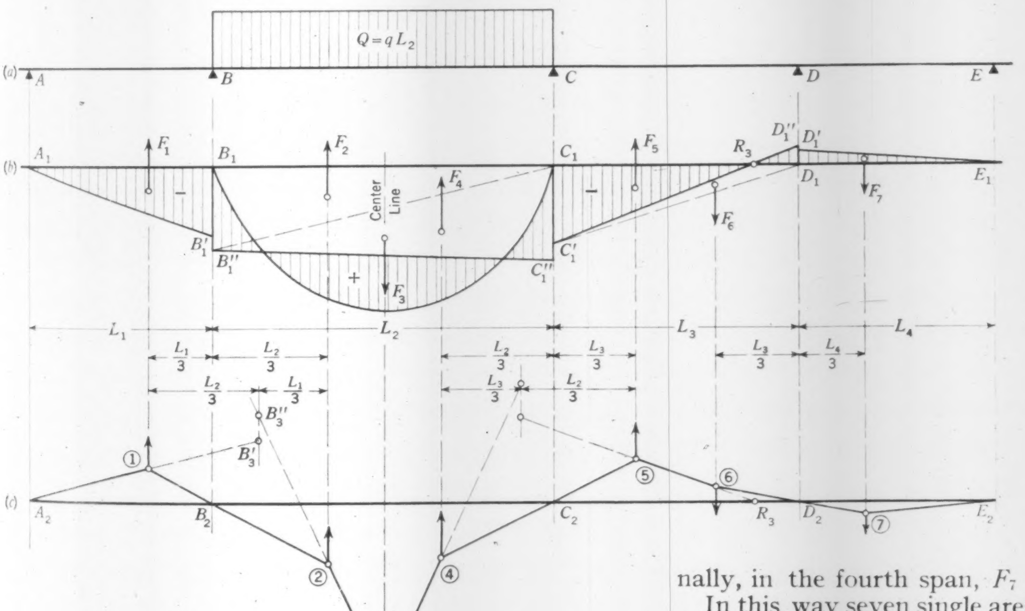


Fig 1

In Fig. 1 (*a*) is shown a continuous beam $ABCDE$ with elastic supports at B, C, and D. The second span only is loaded. If the deflection angle at B is assumed to be u, then the resistance of the support B will have a moment M^B, and we may write $M^Bt = u$, where t depends upon the elasticity of the support, and is the deflection for a moment $M = 1$.

The moment to the left of support B may be called M_1^B, and the one to the right, M_2^B, where the subscripts refer to spans and the superscripts to supports. The following relation must exist:

$$M^B = M_2^B - M_1^B$$

The same condition exists at support C, M_3^C being less than M_2^C.

In Fig. 1(*b*), the closing lines A_1B_1', $B_1''C_1''$, $C_1'D_1''$, and $D_1'E_1$ are not continuous. It is evident that the drop in moment represented by $B_1'B_1''$ must be equivalent to the moment M^B taken by the support B. Similarly $C_1'C_1''$ represents the moment taken by support C.

The tangents at the supports of the elastic line of the continuous beam are determined as shown in Fig. 1(*c*). To understand the construction, let us "work backward," assuming for the present that the moments and moment areas as shown in Fig. 1(*b*) are known. Consider these moment-areas as loads, F_1, F_2, F_3, . . . , and construct a force polygon, with a pole distance of unity, for these loads divided by EI.

On the first span we have a triangular load-area $F_1 = M_1^BL_1/2EI$ The moment-area in the second span is assumed to be the difference between the area F_3, which represents the moment-area for the beam BC if freely supported, and the two triangular load areas $F_2 = M_2^BL_2/2EI$ and $F_4 = M_2^CL_2/2EI$. The area-load in the third span is the difference between the negative triangle area-load F_5 (or $M_3^CL_3/2EI$) and the positive triangle area-load F_6 (or $M_3^DL_3/2EI$). Finally, in the fourth span, $F_7 = M_4^DL_4/2EI$.

In this way seven single area-loads have been obtained, of which six represent areas of triangles. The centers of gravity of these triangles are always located on the third-point lines (assuming a constant moment of inertia in each span of the beam).

These six area-loads are now placed in the center of gravity of corresponding areas, with positive area-loads downwards, and negative area-loads upwards. Following construction of the force polygon, the equilibrium polygon A_2–1–2–3–4–5–6–7–E_2 can be drawn. If the assumed moments were correct, this polygon must go through the supports, as shown by Fig. 1(*c*); and the rays 1–2, 4–5, and 6–7 will represent the tangents to the elastic line in supports *B*, *C*, and *D*, respectively.

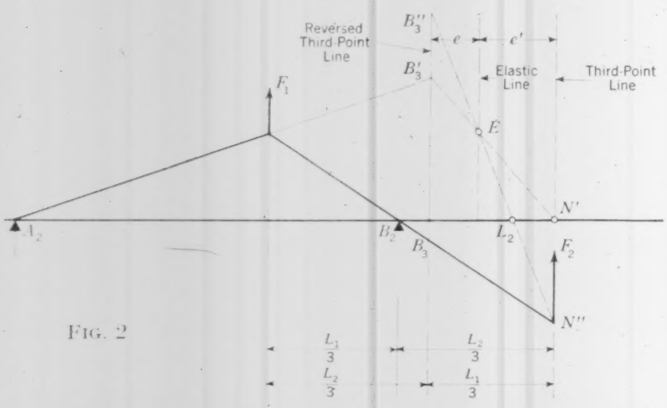


FIG. 2

The first and the third ray, extended to the reversed third-point line, locate the points B_3' and B_3''. The offset $B_3'\,B_3''$ is caused by the elastic resistance of the support *B*, represented in Fig. 1(*b*) by the area-load $B_1'B_1''C_1$. (If there were no elastic resistance from support *B*, points B_3' and B_3'' would coincide, as then $B_1'B_1''$ would be zero.)

Now the extension of the third ray also passes through B_2C_2 in the left "fixed point" of that span. If, therefore, some method of locating this and the other fixed points can be evolved which does not depend on a prior knowledge of the moment areas, these points can be used for the solution of the problem. The following paragraphs develop such a method.

Refer first to Fig. 2. It will be noted that A_2B_3', B_2N'', and $N''B_3''$ are identical with the first three rays in Fig. 1(*c*). Therefore the line B_2N'' gives the deflection angle *t* of the beam at support *B*. In Fig. 2 the line $B_3'N'$ also appears. This intersects $B_3''N''$ at *E*, and the vertical through *E* is designated the "elastic line." Now, conversely, if the location of the elastic line were known, $B_3'N'$ would serve to locate *E*, and EN'' would establish the fixed point L_2.

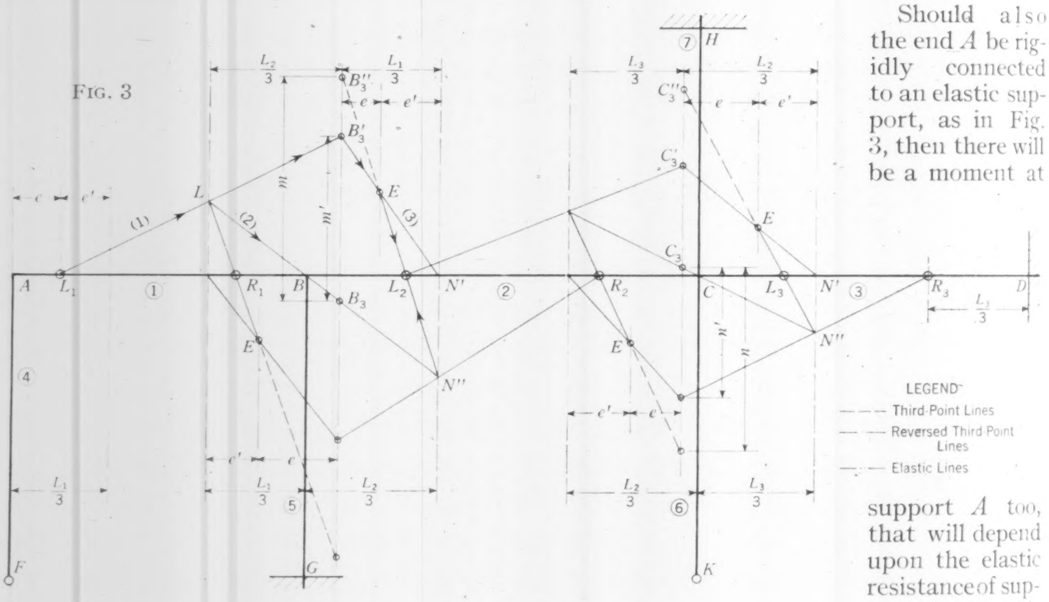


FIG. 3

In order to determine the elastic line, the ratio e:e' must be found. Figure 2 shows that

$$\frac{e}{e'} = \frac{B_3'B_3''}{N'N''} \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

The law of parallel forces says that the product of $B_3'B_3''$ times the pole distance (unity) equals the statical moment of the area-load $B_1'B_1''C_1$ with reference to the B_3-line (the reversed third-point line). As this area-load is a part of F_2, and consequently is applied in N'', we know that the lever arm must equal $L_1/3$, so we get

$$B_3'B_3'' = \frac{M^B L_1 L_2}{6EI} \quad \ldots\ldots\ldots\ldots\ldots [2]$$

In triangle $B_2N'N''$ we know that B_2N'' represents the deflection angle *t* at support *B* of beam *BC*. Therefore

$$N'N'' = \frac{L_2 \tan t}{3} = \frac{L_2 t}{3} \quad \ldots\ldots\ldots\ldots [3]$$

as *t* is very small.

The angle *u* of the beam at support *B* is the same as the deflection angle of the column at support *B*. Let t^B be the deflection angle for a moment $M = 1$ for a specified support *B*. Then the total deflection in *B* for a moment M^B will be $u = M^B t^B$, and introducing this value in Eq. 3,

$$N'N'' = \frac{M^B t^B L_2}{3} \quad \ldots\ldots\ldots\ldots\ldots [4]$$

Then, by combining Eq. 1 with Eq. 2 and Eq. 4,

$$\frac{e}{e'} = \frac{L_1}{2\,EI\,t^B} \quad \ldots\ldots\ldots\ldots\ldots\ldots [5]$$

where t^B represents the deflection angle at support *B* for a moment $M = 1$ applied at the support, and L_1 is the length of the previous span.

Similarly we get for support *C*,

$$\frac{e}{e'} = \frac{L_2}{2\,EI\,t^C} \quad \ldots\ldots\ldots\ldots\ldots\ldots [6]$$

Should also the end *A* be rigidly connected to an elastic support, as in Fig. 3, then there will be a moment at support *A* too, that will depend upon the elastic resistance of support *A*. In this case,

$$\frac{e}{e'} = \frac{L_1}{2EI\,t^A} \quad \ldots\ldots\ldots\ldots\ldots\ldots [7]$$

In Eq. 7, note that L_1 is the length of the beam in the first span.

Equations 5, 6, and 7 express the ratios e:e' in terms of the deflection angles *t* for a unit moment at the respective supports. Considering members with constant moment of inertia only, we have the following general formulas for the angle *t:*

1. *Single Columns Only.*

A. Restrained at the base (as Column 5, at support *B*, in Fig. 3):

$$t = t^B = t_5^B = \frac{h_5}{4EI_5} \quad \ldots\ldots\ldots\ldots\ldots [8]$$

B. Hinged at the base (as Column 4, at support A, Fig. 3):

$$t = t^A = t_4^A = \frac{h_4}{3EI_4} \quad \text{[9]}$$

2. *Double Columns* (as Columns 6 and 7, at support C, Fig. 3):

$$t = t^C = t_{6\text{-}7}^C = \frac{1}{\frac{1}{t_7^C} + \frac{1}{t_6^C}} = \frac{t_6^C \times t_7^C}{t_6^C + t_7^C} \quad \text{[10]}$$

In Eq. 10 the values of t_6^C and t_7^C are determined from Eq. 8 if the base is fixed (applies to t_7^C in Fig. 3) or from Eq. 9 if the base is hinged (applies to t_6^C in Fig. 3).

Figure 3 shows how the fixed points are found. First the third-point and the reversed third-point lines are drawn. (In case the two adjoining beams have different moments of inertia, say I_1 and I_2, then the reversed third-point line is obtained by dividing the distance between the adjoining third-point lines in the ratio $L_1I_2 : L_2I_1$.) Then the distance $L_1/3$ to the right of support B is divided into parts of the ratio $e:e'$, and the E-line is drawn.

In the same manner these lines are located at supports C and D. Then the line (1) is drawn from L_1 in any direction we choose. From its intersection, L, with the right third-point line of Span AB, line (2) is drawn through B to intersect the left third-point line of Span BC in N''; and from its intersection, B_3', with the reversed third-point line, line (3) is drawn to point N', intersecting the elastic line in E. Finally, EN'' is drawn, locating L_2, the left fixed point in the second span. The same procedure, repeated from L_2 as a starting point, will give the fixed point L_3 in Span 3.

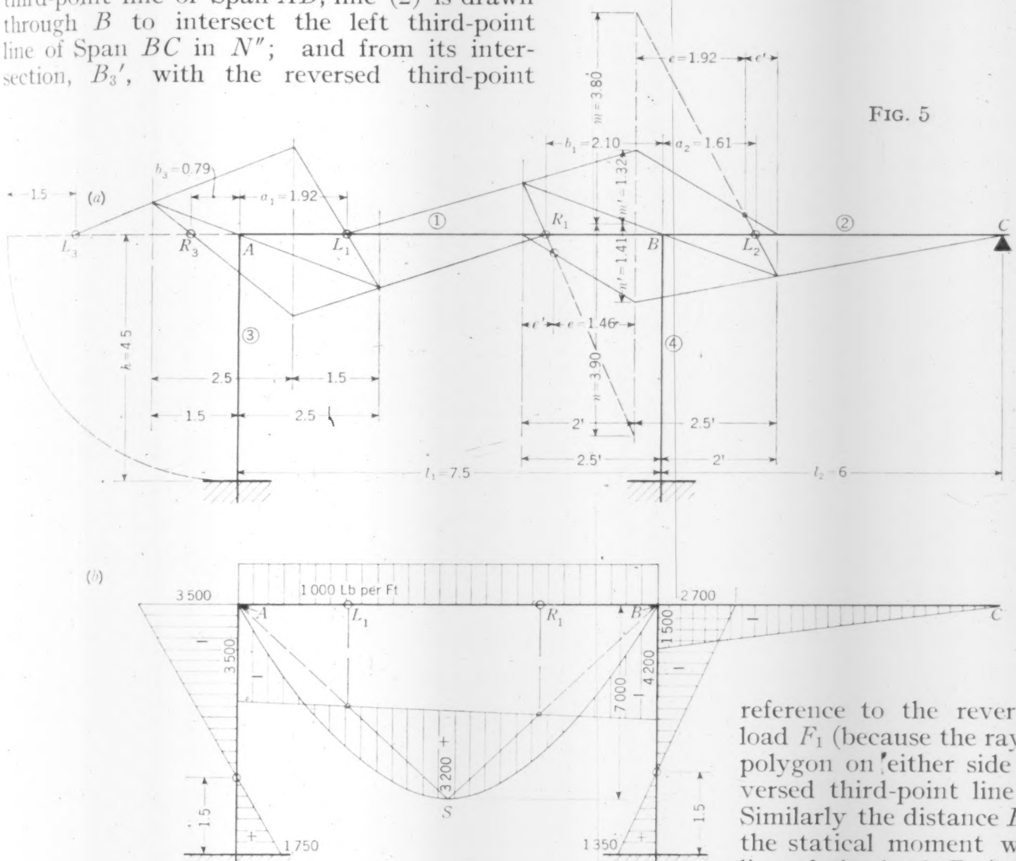


FIG. 5

Similarly the right fixed points ("R-points") are located by starting at the right end and moving left. The same three vertical lines are used, but the left reversed third-point distance is now used in locating the E-line.

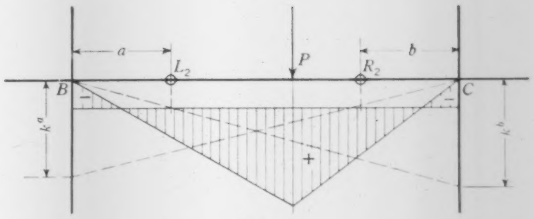


FIG. 4

Should the elastic resistance disappear, then the E-line coincides with the reversed third-point line. Should complete restraint exist, then $t = 0$, and the E-line coincides with the third-point line.

It is evident that the five vertical lines at each support are independent of the loading, and are necessary only for the construction of the fixed points. As soon as these fixed points have been determined, these lines can be discarded.

The moments in the loaded span can now be found in exactly the same way as for a continuous beam on free supports. The construction is shown in Fig. 4, which represents the loaded span, with the fixed points L_2 and R_2 known. The moment-area for this span, assumed to be a single beam freely supported, is first plotted. Next the "cross-line distances" k^a and k^b are computed and the cross-lines are drawn. Finally, verticals dropped from L_2 and R_2 to the cross-lines locate the closing line.

The cross-line distances depend only upon the free moment-area. Thus k^a equals the statical moment of this area with reference to support B divided by $L^2/6$, and k^b equals the statical moment of this area with reference to support C divided by $L^2/6$.

In order to find the moments outside the loaded span, it is necessary to decrease the support moments every time they pass over an elastic support. The amount of decrease may be found from a study of Figs. 2 and 3.

The distance B_3B_3' (marked m') represents the statical moment, with reference to the reversed third-point line, of the load F_1 (because the rays a and b in the equilibrium polygon on either side of F_1 intersect with the reversed third-point line in the points B_3 and B_3'). Similarly the distance B_3B_3'' (marked m) represents the statical moment with reference to the same line of the load F_2 (because the rays b and c in the polygon on either side of F_2 intersect with the reversed third-point line in the points B_3 and B_r'').

It will thus be seen that the distances m' and m relate to each other as the moments on either side of the support B.

Therefore the moment-reducing factor in support B, giving the reduction in a moment traveling from Span 2 to Span 1 over support B (see Fig. 3) is

$$w_{2\text{-}1}^B = \frac{m'}{m} \quad \text{[11]}$$

where we read the moment reducing factor thus: "in B, from 2 to 1."

Similarly for support C we get (see Fig. 3)

$$w_{2\text{-}3}^{C} = \frac{n'}{n} \qquad [12]$$

It will be noted that the moment reduction factor $w_{2\text{-}1}$ (from right to left) is determined by the construction of the left fixed points, and that $w_{2\text{-}3}$ (from left to right) is determined by the construction of the right fixed points.

Should the beam be freely supported at some support, then $w = 1$. For each elastic support there are two values of w, depending upon whether the moment passes the support from right to left or vice versa. These values depend only upon the elastic conditions of the supports and the beams, and are independent of the loading. They may be determined by simply scaling on the reversed third-point line the distances B_3B_3' and B_3B_3'', after the fixed points have been determined. As only a ratio is required, any convenient scale may be used.

As an example of the application of the fixed-point method, consider Fig. 5. Let it be required to find the moments throughout the frame for a uniformly distributed load on beam AB only of 1,000 lb per ft.

The Left Fixed Points. Support A is elastic, so in the first third-point distance ($L_1/3 = 2.5$) the elastic line is located by the ratio $e:e'$, which from Eqs. 7 and 8 equals 10/3. Now $e + e' = 2.5$, so $e = 1.923$. This value directly locates the left fixed point L_1.

Support B is also elastic. From Eq. 5,

$$\frac{e}{e'} = \frac{L_1}{2EI\ t^B}$$

As the reversed third-point distance equals 2.5 again, and $t^B = t^A$, we get as before, that $e = 1.923$. This locates the elastic line to the right of support B, whereupon the four construction lines started from L_1 locate the fixed point L_2.

The Right Fixed Points. Support C is hinged, hence the right fixed point R_2 will coincide with the support.

Support B is elastic, so the elastic line will be located to the left of this support by the ratio $e:e'$ in the reversed third-point distance $L_2/3 = 2.0$. Here

$$\frac{e}{e'} = \frac{L_2}{2EI\ t^B} = \frac{8}{3}$$

and since $e + e' = 2$, $e = 1.455$. This locates the elastic line to the left of support B, whereupon the four construction lines started from C locate the right fixed point R_1.

Moment Reduction Factors. The moment at A from beam AB will go directly into Column 3 at A, without reduction, as there is only one member. Hence $w_{1\text{-}3}^{A} = 1$.

The moment at B from beam AB is split; one part M_2^B goes into beam BC, and one part M_4^B goes into Column 4. The moment reduction factor at support B—left to right—is obtained by scaling $n' = 1.41$ and $n = 3.90$ at any convenient scale. Hence

$$w_{1\text{-}2}^{B} = \frac{1.41}{3.90} = 0.36$$

The Moments. The uniformly distributed load of 1,000 lb per ft is now applied to Span AB (see Fig. 5b). The vertex, S, of the parabola is at a distance down of

$$M = 1{,}000 \times 7.5^2/8 = 7{,}031 \text{ lb-ft}$$

The intersections of the vertex-lines SA and SB with verticals through L_1 and R_1 locates the closing line, solving the problem for beam AB. At support A we scale $M_1^A = -3{,}500$ lb-ft. Therefore $M_3^A = -3{,}500$ lb-ft, and $M_3^D = +1{,}750$ lb-ft. At support B we scale $M_1^B = -4{,}200$ lb-ft. Therefore $M_2^B = -4{,}200 \times 0.36 = -1{,}500$ lb-ft, and $M_4^B = -4{,}200 + 1{,}500 = -2{,}700$ lb-ft. Therefore, also, $M_4^E = +1{,}350$ lb-ft.

Attention is called to the alternate construction in Fig. 5 of the fixed point L_1. Column 3 is assumed to be a beam in the continuation of beam AB. The ordinary graphical construction for beams on free supports is used.

A Drilling Rack for Shaft Sinking

By SIDNEY M. MARKS, JUN. AM. SOC. C.E.

ENGINEERING INSPECTOR, GRADE 4, BOARD OF WATER SUPPLY, SHAFT 17, VALHALLA, N.Y.

AT Shaft 17 of the Delaware Aqueduct, there is now in use a drilling rack that applies some of the new tunnel methods to shaft sinking. This machine (Fig. 1) consists of a center column containing air and water manifolds and a rack for carrying as many as 12 drills.

Before lowering into the shaft, each jackhammer is placed in one of the compartments of the rack. Air and water connections are permanently made to the manifolds, and the hoses coiled and hung on hooks provided

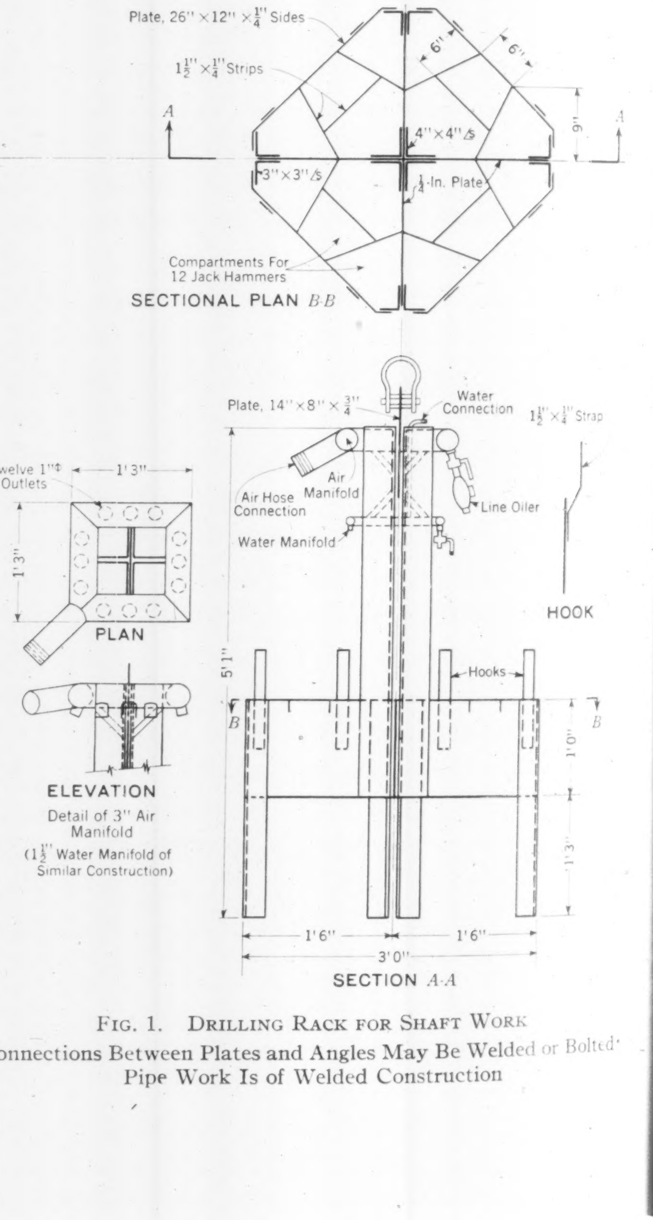
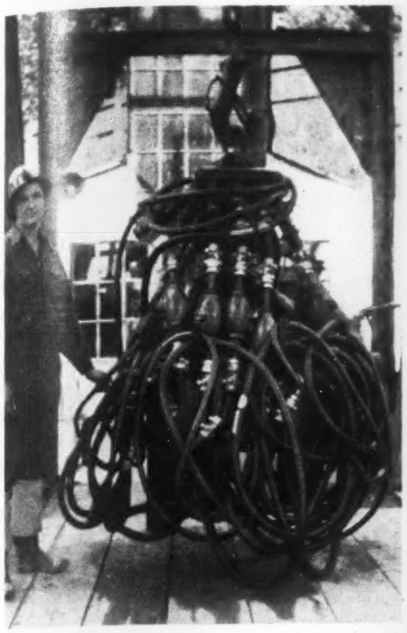


FIG. 1. DRILLING RACK FOR SHAFT WORK

Connections Between Plates and Angles May Be Welded or Bolted; Pipe Work Is of Welded Construction



DRILL RACK READY TO BE LOWERED INTO SHAFT

for that purpose. The rack is lowered into the shaft by means of a shackle on top. At the bottom the device remains in the center of the excavation and but two connections are made—a flexible hose to the air manifold and one to the water connection.

Each man takes his machine from the rack and moves out radially from the carriage into drilling position without any loss of time. Since the center holes are drilled 2 or 3 ft from the center line of the shaft, it is not necessary to shift the rack until the bottom is drilled out. As each man finishes, he places his drill back in the rack. Upon completion of drilling, connections are broken, and the rig is hoisted back to the surface.

In the interval before the next drilling cycle starts, the "drill doctor" has ample time to service each drill.

This drill rack has three important advantages over the older methods: (1) It saves repair costs since the biggest cause of drill damage—rock dust entering the exhaust port of the jackhammers—is eliminated, because the machines are never laid on the ground. Very often when drills are connected to a manifold at the bottom of the shaft, rock dust gets into the lines through the hose. This too will be minimized since only one air connection is made, and that by a pipefitter. (2) A saving in time results since there is no time lost in unloading and connecting drills. And (3), lowering this machine is probably safer than lowering a wide assortment of drills, hose, and connections in a bucket or swinging loose.

The device described here was built by Associated Contractors, Inc., under the supervision of Clyde Turner, superintendent in charge of Shaft 17.

Miscellaneous Practices in Theater Construction

By GEORGE VIERTEL, JUN. AM. SOC. C.E.

CONSTRUCTION SUPERINTENDENT, M. SHAPIRO AND SON, NEW YORK, N.Y.

THE purpose of this article is to bring out some of the specialized points of theater construction with which the engineer must be familiar if he is to lay out or supervise the work.

The foundation for the structure is, of course, the first problem to be met. Foundation walls should be "stepped" in accordance with the changes in grade of the auditorium. It is possible, of course, to slope the side walls to the sweep of the auditorium floor, but stepping is the better practice. Further, it seems best to make the grade of each step the same as that of the next lower floor contour shown on the plans, so as to be sure that none of the concrete foundation will extend above the finished floor.

For laying out the auditorium floor the following suggestions should prove of value. The rear curve, or standee rail (Fig. 1), should be established first, by offsets at say 5-ft intervals from a chord through the intersections of the curve with the side walls. The stakes marking the curve should be driven at a distance from the base line equal to the calculated offsets plus 1 in.; a 1 by 2-in. furring strip is then nailed to the stage side of these stakes, with its top edge at the grade of the finished floor.

To set the remaining arcs, a large job-made square like the one shown in Fig. 2 can be used. Side *AB* should be about 3 or 4 ft long, and side *BD* about a foot longer than the interval between the screed lines (which in the case shown in Fig. 1 is 8 ft). A mark, *C*, should be made at a distance from *B* of 1 in. less than this interval. The angle *ABD* is 90 deg. (Theoretically, to get side *BD* truly radial, a T-square would be required; however, the difference in results is negligible, and the T-square is much more cumbersome to handle.)

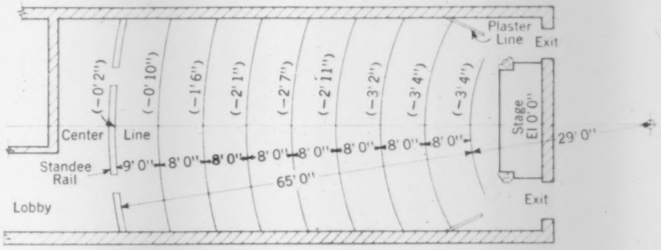


FIG. 1. AUDITORIUM FLOOR OF SMALL MOVIE THEATER, SHOWING FLOOR CONTOURS (STAGE FLOOR ELEVATION TAKEN AS DATUM)

Side *AB* of this square is placed against the stage-side of the furring strip on the arc first laid out, and a stake is driven with its stage side at point *C*. This is repeated at various points along the arc until sufficient stakes have been set. The grade of the next arc is then marked on each of the new stakes and, as before, a furring strip is bent and curved to fit the stage-side of these stakes, thus making up the full interval between floor contours. This procedure is repeated until all the arcs have been laid out. The furring strips serve as an accurate guide for grading and pouring the floor, and are removed as the floor is poured.

Another point of some importance is the order of plastering and floor-pouring operations. For work on the job the plasterer generally erects a pole scaffold. This should not be put up until the auditorium floor concrete has been laid and protected with building paper and sand. If the scaffold is built before the floor is laid, the laying out of the screeds and the screeding of the floor is more difficult, and the holes left around

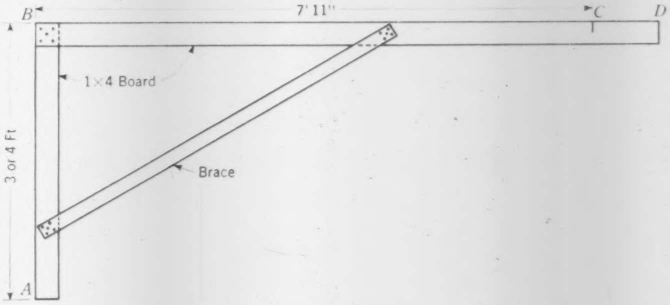


FIG. 2. SQUARE USED FOR LAYING OUT FLOOR

the scaffold poles when the floor is poured must later be patched. Patching often causes trouble in the installaton of the chairs, due to decrease in bond between the patches and the floor itself.

Finally, attention should be called to special points in connection with the use of acoustic plaster. This material is not adaptable to run-work, such as cornices, or to ornamental work, such as plaques and designs, but is used in ceiling and wall panels. Before applying it, the job superintendent or engineer must make certain that there are no leaks in the roof or in any of the mechanical systems above the plaster, for acoustic plaster, once applied, must not get wet. If it does, the whole panel or complete ceiling will have to be replaced; for a spot will always show, even after painting and decorating.

Below the dado or chair rail, the walls are generally plastered with Keene's cement, which is resistant to wear and does not rub off.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Fatigue Tests of Riveted Joints

To the Editor: The investigation of fatigue properties on riveted joints, described in Professor Wilson's paper in the August issue, when started in Europe encountered the difficulties mentioned by Professor Wilson. I had the opportunity to carry out similar tests for the German State Railroad from 1926 to 1936, and a brief description of the results of these investigations may be of some interest.

The fact that the endurance limit as determined under complete stress reversal is almost no higher for certain high-grade steels than for normal mild-carbon steel, as described in Professor Wilson's paper, led to the conclusion that to take advantage of the higher yield point of high-grade steels, the static pre-stress caused by the dead load must be considered. Hence a dynamic formula was introduced, taking into account the fact that, at least for the main girders of bridges, the dead load plays an important rôle. The allowable stresses could then be raised considerably for high-grade steel, whenever the dynamic stresses were either in the tension or the compression range. This was the only way to take advantage of the improved qualities of high-grade steels. For floor girders the influence of the dead load is much smaller, leading in certain cases to the exclusion of higher grade steels for cross girders and stringers.

Fatigue tests on riveted joints revealed the same strange facts described by Professor Wilson. Making rivets of steel with higher static qualities than the connecting plates did not improve the endurance limit. In some cases rivets of high-grade steel even decreased the fatigue limit of the joint. The fundamental advantage of the riveted connection, especially when compared with welded or concrete structures, lies in its elastic behavior. The slipping of the rivets, after the first application of alternating loads, is important. Excessive rigidity of the rivets prevents this settling effect, which forms a very effective adjustment, helping to distribute the loads more evenly over the complete connection. Hence, it was concluded that, from the dynamic viewpoint, the material of the rivets must have a slightly lower yield point than the material of the connecting plates in order to give the most efficient joint.

Furthermore, the question of any period of rest became of primary importance. In order to obtain relative results without spending an excessive time for such investigations, tests were made, in which the frequency of the alternating load was raised substantially, up to 20 cycles per sec, thus making it possible to introduce longer periods—12 hours or more—of complete rest. These investigations could be compared with tests of the same high frequencies, or of lower frequencies, without periods of rest. No considerable difference could be detected when introducing the periods of rest. Furthermore, the raised frequency showed no change in the fatigue limit as compared with that given by low-frequency tests.

Finally, the fact remains that almost no bridge has failed on account of fatigue cracks—for the most part because of the "shrewdness" of the material—except in the case of stringer connections. Therefore, the somewhat discouraging results of complete stress reversal tests just described are not to be taken too seriously. This fact led to tests on actual structures or, at least, on complete models. The problem may be stated as: "Ask the structure in the field." To get the answer, the so-called "Oscillator" method (described by the writer in Civil Engineering for April 1937) was developed. This method applies the required dynamic loads in combination with the dead load on the actual structure in the field or on models of almost the same size on a test stand. The important influence of the structural form—the "shape" factor—could be isolated by these tests, thus leading to substantial improvements from the dynamic viewpoint—in other words, raising the fatigue limit considerably.

R. K. Bernhard
Professor and Head of Department of Mechanic
and Materials of Construction,
The Pennsylvania State College

State College, Pa.

Closing Discussion on the Equiangular Strain Rosette

Dear Sir: The selection of the number and orientation of gage lines for a strain rosette depends upon a great many factors. Important among these are the measuring instruments to be used, the test procedure, the precision required, and the area to be covered by the rosettes. After the type of rosette has been chosen, it is further required to adopt a method for converting the gage readings to components of strain or stress so that the data may be more easily interpreted. This conversion may be carried out on a calculating machine, or with charts and nomographs, or by any one of several geometrical constructions.

The purpose of my article, "The Equiangular Strain-Rosette," in the August issue, was to point out, to those who are not familiar with the strain-rosette technique, the principles involved in the conversion of rosette readings to stress and strain components. The equiangular arrangement of three gage lines was chosen simply as an illustrative example.

Mr. Gray, discussing my article in the September issue, interprets it as a recommendation of the equilateral arrangement to the exclusion of all others. It was specifically stated in the article that "the same procedure may be followed to obtain formulas for three gage lines inclined at any other angles with each other." There is, however, one great advantage that the equiangular arrangement has over all other rosettes composed of three gage lines. I refer to the fact that units of equilateral triangles or hexagons will completely cover an area without overlapping. This results in a minimum number of gage points and, on account of the symmetry of the arrangement, a minimum number of attachments which are necessary to hold certain types of strain gages to the test piece.

Mr. Gray also calls attention to the use of four gage lines. There are two questions which must be answered before the four gage-line technique can be accepted: (1) How shall the four readings be converted to stress and strain components? (2) Shall we use four gage lines at all? I have discussed both these questions before (*Engineering News-Record*, April 7, 1938, page 492).

Mr. Gray agrees with my previous statement that "If four measurements are to be taken, they should be used in groups of three to calculate the state of strain and the separate results should then be compared. In this way, the extra reading is used as a check." The calculations may be carried out by the method described in my Civil Engineering article, or they may be carried out graphically, as Mr. Gray points out, by the "dyadic circle" method described by Osgood and Sturm. (Mr. R. L. Templin also has called attention to the paper by Osgood and Sturm in a private communication.) The "Mohr Circle" construction may also be conveniently used. Whether analytical or graphical methods are used is a matter of personal preference. There are some who prefer to work over a drafting board and others on a calculating machine.

With regard to the advisability of using four gage lines at all, I shall again quote from my statements in the *Engineering News-Record:*

"Check measurements can also be made with a three gage-line rosette either by repeating the measurements or by using successive load increments. This procedure is customary and advisable in any case.

"What, then, is the advantage of the four gage lines? The calculation formulas for three lines are of the same order of simplicity as those for four lines . . . .

"The only possible advantage of the four lines might lie in an increase of overall precision of measurements. An analysis of this consideration shows that the advantage is small . . . .

"It seems reasonable to conclude that the slightly higher precision obtained with four gage lines does not compensate for the additional labor involved in taking an extra strain measurement on each rosette, especially since repeated measurements are necessary in either case."

Raymond D. Mindlin, Jun. Am. Soc. C.E.
Instructor in Civil Engineering,
Columbia University

New York, N.Y.

Conversion from Geodetic to Plane Coordinates

Dear Sir: The superiority of the modern computing machine over logarithms for many purposes has been demonstrated frequently. One type of problem for which the machine is particularly advantageous is the interconversion between geodetic coordinates and plane coordinates on the recently adopted state systems. The article by A. C. Kalbfleisch, in the September issue, illustrates this point. The conversion from geodetic to plane coordinates is presented in the U. S. Geological Survey's booklet, "Formulas and Tables for the Transformation of Geodetic to Plane Coordinates on the Lambert and Transverse Mercator Projections." Mr. Kalbfleisch presents the inverse problem for the Lambert projection The following explanation of the same problem on the transverse Mercator projection completes the series. The formulas are based on those presented in the above-mentioned booklet, and the page numbers refer to the tables of factors presented therein. Special reference is made where necessary to the zone tables computed by the U. S. Coast and Geodetic Survey. All symbols have the same significance as in the original formulas, except that ϕ_1 and s_1 are preliminary values of ϕ and s, respectively. The formulas are:

ϕ_1 is found for y from Zone Table 1.

$$s_1 = x - 500{,}000$$

$$\phi = \phi_1 - \frac{s^2}{C_2\,\delta y} \qquad s = s_1 - C_1 s_1^3$$

$$\Delta\lambda = \frac{s A}{\cos\phi\, K_R}$$

$$\lambda = \lambda_0 - \Delta\lambda$$

C_1 is found on page 7 for latitude ϕ_1, and C_2 is found for latitude ϕ_1 in Part 1 of the tables on pages 8–11. The corrections in Part 2 are not used. δy is the tabular difference in y, taken from Zone Table 1. A is found on page 7 for latitude ϕ. Cos ϕ is taken from a table of natural functions. K_R for the zone is found on page 6, and λ_0 may be found in the zone tables. For points in New Jersey, 2,000,000 should replace 500,000 in the x-transformation.

To illustrate the method, the geodetic position of station Block Island, in Rhode Island, will be computed from its plane coordinates, $x = 474{,}705.26$ and $y = 33{,}566.41$. The marginal numbers indicate the order of the operations.

1. $\phi_1 = 41^\circ\, 10'\, 31.6569''$

2. $s_1 = 474{,}705.26 - 500{,}000.00 = -25{,}294.74$

3. $C_1 s_1^3 = (+.092)\,(-.25)^3 = .00$

4. $s = s_1 - C_1 s_1^3 = -25{,}294.74$

5. $\dfrac{s^2}{C_2\delta y} = \dfrac{(-25.29474)^2}{47.9189 \times 101.20900} = +.1319''$

6. $\phi = 41^\circ\, 10'\, 31.6569'' - .1319'' = 41^\circ\, 10'\, 31.525''$

7. $\Delta\lambda = \dfrac{-25{,}294.74 \times .03229{,}1525}{.752{,}6973 \times 3.280{,}812{,}828} = -330.763'' = -5'\, 30.763''$

8. $\lambda = 71^\circ\, 30'\, 00.000'' - (-5'\, 30.763'') = 71^\circ\, 35'\, 30.763''$

Julius L. Speert, Assoc. M. Am. Soc. C.E.
Assistant Topographic Engineer,
U. S. Geological Survey

Washington, D.C.

Sanitary Engineering Not a New Science

To the Editor: Those of the present generation who have the idea that sanitary engineering is a new science will be interested in the following quotation from Robert Burton's *The Anatomy of Melancholy*, first printed in 1621. In analyzing melancholy (after the manner of Freud 250 years later), he assigns impure water as one of the causes. The italic phrases are Latin quotations translated.

The quotation reads as follows: "Standing waters, thick and ill coloured, such as come forth of pools and moats, where hemp hath been steeped, or slimy fishes live, are most unwholesome, putrefied, and full of mites, creepers, slimy, muddy, unclean, corrupt, impure, by reason of the sun's heat, and still standing. They cause foul distemperatures in the body and mind of man, are unfit to make drink of, to dress meat with, or to be used about man inwardly or outwardly. They are good for many domestical uses, to wash horses, water cattle, etc., or in time of necessity, but not otherwise. Some are of opinion, that such fat standing waters make the best beer, and that seething doth defecate it, as Cardan holds, *it mends the substance and savour of it*, but it is a paradox. Such beer may be stronger but not so wholesome as the other, as Jobertus truly justifieth out of Galen, that the seething of such impure waters does not purge or purify them. Pliny is of the same tenet, and P. Crescentius, Pamphilius Herilachus, (says) such waters are naught, not to be used, and, by the testimony of Galen, *breed agues, dropsies, pleurisies, splenetick and melancholy passions, hurt the eyes, cause a bad temperature and ill disposition of the whole body, with bad colour*. This Jobertus stiffly maintains, that it causeth blear eyes, bad colour, and many loathsome diseases, to such as use it. This which they say stands with good reason; for, as Geographers relate, the water of Astracan breeds worms in such as drink it. Axius, or (as now called) Vardar, the fairest River in Macedonia, makes all cattle black that taste of it. Aliacmon, now Peleca, another stream in Thessaly, turns cattle most part white, if you take them there to drink. J. Aubanus Bohemus refers that *struma*, or poke, of the Bavarians and Styrians, to the nature of their waters, as Munster doth that of the Valesians in the Alps, and Bodine supposeth the stuttering of some families in Aquitania, about Labden, to proceed from the same cause, *and that the filth is derived from the water to their bodies*. So that they that use filthy, standing, ill-coloured, thick, muddy water, must needs have muddy, ill-coloured, impure and infirm bodies. And because the body works upon the mind, they shall have grosser understandings, dull, foggy, melancholy spirits, and be really subject to all manner of infirmities."

Paul M. LaBach, M. Am. Soc. C.E.
Consulting Engineer

Los Angeles, Calif.

SOCIETY AFFAIRS

Official and Semi-Official

And Next—The Eighty-Sixth Annual Meeting

Sessions and Excursions Scheduled for January 18–21, 1939, in New York City

Most important event of the Society's calendar for the winter months is the Eighty-Sixth Annual Meeting, which will be held in New York City on January 18–21, 1939. Plans are now nearly complete for the four days of technical and social activity, and the final program, with complete details, will be published in the January issue. Somewhat earlier, a summary program will be mailed to every member, outlining the various events and enclosing a form for advance registration and ordering tickets.

Events of the Opening Day

The Annual Meeting will open on Wednesday, January 18, with a morning session in the auditorium of the Engineering Societies Building. Though the program includes reports of the Board, the Treasurer, and the Secretary, and a brief business meeting, its principal feature will be the simple but impressive ceremonies that accompany the conferring of honorary memberships and the awarding of prizes.

This year five members of the Society—the maximum number permitted by the Constitution in any one year—will be added to the notable group that comprise the honorary membership. They are: C. Frank Allen, Anson Marston, Arthur S. Tuttle, Edward E. Wall, and Frank E. Weymouth.

Five men, also, comprise the list of prize winners who will be honored at the opening session; the award in each case is for a paper of outstanding merit which has appeared in the Society's publications. The Norman Medal will be awarded to Hunter Rouse, Assoc. M. Am. Soc. C.E.; the J. James R. Croes Medal to E. C. Hartmann, Assoc. M. Am. Soc. C.E.; the James Laurie Prize to Leon S. Moisseiff, M. Am. Soc. C.E.; the Arthur M. Wellington Prize to Charles M. Noble, M. Am. Soc. C.E.; and the Collingwood Prize for Juniors to Douglas M. Stewart, Jun. Am. Soc. C.E.

With one or two possible exceptions, all the new honorary members and prize winners will be present in person to receive their awards. Following these ceremonies, and the business meeting, the President-elect and the new Vice-Presidents and Directors will be introduced.

As usual, there will be a luncheon in the Engineering Societies Building following the morning session. This event is entirely informal, there being no fixed seating arrangements and no program.

It provides one of the finest opportunities of the entire Meeting for small groups to gather and renew or extend their acquaintance, and has been increasing in popularity for several years.

The Wednesday afternoon session is being arranged by the Society's Committee on Professional Advancement. Details are still in process of development, but it is expected that the program will consist of a symposium in which representatives of a number of professions will speak on measures and activities to improve the economic, social, and professional standards in their respective fields.

Wednesday evening has been set aside for the formal social event of the meeting—the dinner, dance, and reception to be held at the Hotel Waldorf-Astoria.

Technical and Social Events on Thursday

Thursday morning and afternoon will be devoted to sessions of the Technical Divisions. Simultaneous meetings will be going on all day in the Engineering Societies Building. Programs are under way for the following Division sessions:

City Planning Division
Engineering Economics Division
Highway Division
Sanitary Engineering Division
Structural Division
Waterways Division

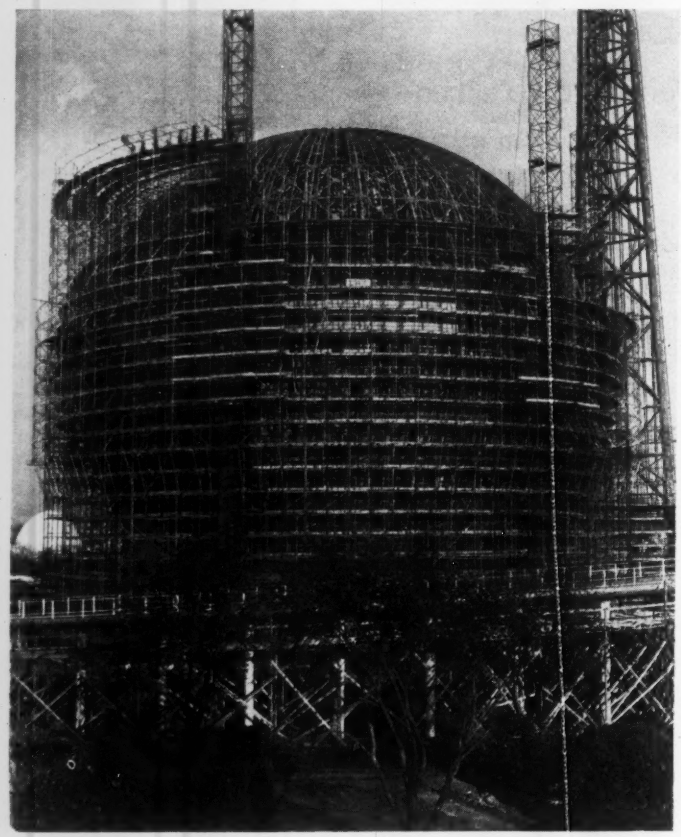
The Sanitary Engineering Division program will be in collaboration with the New York State Sewage Works Association, which will hold its annual meeting in New York during the same week, and the two bodies will join forces on Thursday evening in a special dinner.

On Thursday evening, the Annual Smoker will be held at the Hotel Astor. Those who attended the smoker last year will recall the rapid-fire address of Captain Craig, deep-sea diver and explorer, and will recall also that it was presented almost extemporaneously, following the loss of his moving picture films in transit. This year Captain Craig will return, to present the lecture and deep-sea movies originally on last year's program. Following his address there will be the customary light refreshments and informal entertainment.

Excursion, and Entertainment for Ladies

An all-day excursion of a rather unusual nature is on the program for Friday—a visit to the extensive plant of the Mack Truck Company at Allentown, Pa. The trip will be made by special train, and will be open both to members and to their ladies and other guests as well. Further details cannot be announced at present.

Saturday will be utilized for inspection trips to engineering works in progress in and near New York. Among the possibilities, for which preliminary arrangements are now



Scaffolding Now Surrounds the Perisphere, Theme Center Building of the New York World's Fair

Those Attending the Annual Meeting of the Society Will Have an Opportunity to See a Wide Variety of Structures in Progress of Construction at the Fair Site

In This Issue. . .

Two Amendments to By-Laws Are Adopted . . . . p. 847

Abstract of Local Sections Conference . . . . p. 848

Comments on Local Section Administration . . . . p. 850

Past-President Louis C. Hill Dies . . . . p. 851

Reports of U.E.T., Library, and Engineering Foundation . . p. 852

Activities of Soil Mechanics and Foundations Divisions . . . p. 855

being made, are subway construction, tunnel construction, and—of course—the manifold activities at the site of the World's Fair.

The Ladies' Committee is also making ample plans for entertainment. Definitely on the schedule already are a fashion show and tea, to be held at the Hotel Astor on Thursday afternoon, and a bridge party at the Engineering Women's Club on Thursday evening. The latter event is an alternate to the smoker, at which special balcony seats will be reserved for women who wish to hear the lecture by Captain Craig.

As usual, college and fraternity luncheons and dinners—some of them stag affairs and some for both sexes—will be given throughout the week, rounding out the social program and providing relaxation for the odd hours of days otherwise taken up with more formal events. Such meetings are held in clubs and hotels near the Society's Headquarters.

Post-Meeting Trip to Bermuda Again on the Schedule

Once again arrangements have been made for a post-Meeting cruise to Bermuda at remarkably low rates. This event has been on the program for several years and has been enthusiastically commended by those who have participated in it. One such member has written:

"More of our visiting members should take advantage of the annual cruise rates to Bermuda. After the hustle-bustle of technical meetings and the concentration on Society problems, it is difficult to imagine a more perfect ending to the Meeting program. Both rest and good fun are to be found on this trip. Without becoming a word-juggling, long-haired poet, it is possible on this 1,300-mile voyage to learn new meanings for superlatives such as 'enchanting' and 'entrancing.' One is transported abruptly from winter in New York to a 'mid-ocean paradise' that many of us have only read about in books."

The "inclusive" prices quoted to the Society this year show very decided reductions from the regular tariff. They are even lower than last year. Those making the earliest decisions also get the greatest values because of the flat rate offered for the various room categories. Reservations can be canceled, of course, if conditions later prevent one's going, and the deposit will be returned in full. Information regarding rates and reservations can be obtained from the Secretary's office.

Importance of Early Registration

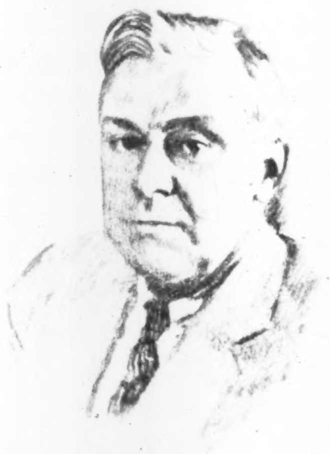
Members are reminded that last year's Annual Meeting set an all-time record for registration, with more than 2,200 names on the list. With the probability that the forthcoming meeting will be even more attractive, members are urged to facilitate the advance planning of trips and social events by returning, as soon as possible, the registration blanks soon to be mailed to them.

Professional Records of Nominees

Brief Biographical Sketches of Candidates for Society Offices

Donald Hubbard Sawyer

Donald Hubbard Sawyer was born at Mount Pulaski, Ill., on August 26, 1879. Graduating from the University of Illinois in 1902, with the degree of bachelor of science, he became associated with Alexander Potter, M. Am. Soc. C.E., engineer of New York City, working on a project of intercepting trunkline sewers adjacent to Newark, N. J. Following this, he was employed on a precise survey of the Central Railroad of New Jersey, and then as a representative of consulting engineers during the construction of the Mountain Home for Disabled Volunteer Soldiers at Johnson City, Tenn. During 1903 he was city engineer and superintendent of water works of Paris, Ill. From 1904 to 1908, he was chief engineer of the Illinois Traction System, and from 1909 to 1917, a member of Sawyer Brothers, with offices in Seattle and Spokane, Wash. The latter company specialized in the design and supervision of construction of hydraulic, sanitary, and other engineering improvements.



Donald H. Sawyer
Nominee for President

Commissioned a major in the Quartermaster Corps in 1917, he had charge of building the original Camp Grant at Rockford, Ill., and then served as Supervising Constructing Quartermaster in charge of warehouses in various cities of the country. He was advanced to the grade of lieutenant colonel and placed in charge of constructing the nitrate plant at Cincinnati, Ohio, and then of completing Camp Bragg at Fayetteville, N.C. Later he was stationed in Washington in connection with closing war-time contracts, being honorably discharged from the army in November 1919, and commissioned a colonel in the Quartermaster Reserve Corps.

Colonel Sawyer was with James Stewart and Company, contractors of New York City, from 1920 to 1923, and then served as secretary of the Associated General Contractors of America in Washington until 1930. After this, he became secretary of the Heating Board of Trade of New York, and in 1931 was appointed director of the Federal Employment Stabilization Board, serving in this capacity until 1935. He was also named temporary administrator of the Federal Emergency Administration of Public Works. Since 1935, he has been a special assistant to the Director of Procurement and chief of the Section of Space Control, which also involved the preparation of an inventory of all federal real estate and improvements, as well as presidency of the U. S. Housing Corporation.

He has contributed articles on a variety of technical subjects to numerous papers and periodicals—among them Civil Engineering.

Colonel Sawyer was elected to membership in the Society in 1909, and served as Director from 1926 to 1928 and as Vice-President in 1935 and 1936. He is a director of the Washington Building Congress; chairman of the Board of Admissions of the Cosmos Club; and trustee of Calvary Baptist Church. He is a member of the Washington Society of Engineers, the American Legion, Quartermaster Association, Construction Division Association of the Army, Phi Gamma Delta, Illini Club, and the Army and Navy Country Club.

Charles M. Reppert

Charles M. Reppert was born in Oakmont (a suburb of Pittsburgh), Pa., on October 10, 1880, and was graduated from Cornell University in 1904 with a civil engineering degree. Following graduation, Mr. Reppert was employed in various capacities in the design and construction of the filtration plant for the City of Pittsburgh. He then entered the service of the City of Pittsburgh

CHARLES M. REPPERT
Nominee for Vice-President,
Zone II

as chief draftsman, and shortly thereafter was appointed designing engineer in charge of the Division of Design of the Bureau of Engineering, Department of Public Works, remaining in this position until 1917. During this period Mr. Reppert had charge of preparing designs, plans, and specifications for street and sewer-improvement projects and was engaged in a number of special investigations.

During the war he was associated with the late Morris Knowles, M. Am. Soc. C.E., as deputy supervising engineer on the construction of Camp Meade, Maryland. Upon the completion of this work, he became deputy chief engineer, later chief engineer, and finally assistant general manager of the Housing Division of the Emergency Fleet Corporation, U. S. Shipping Board.

Following the war, Mr. Reppert joined the firm of Morris Knowles, Inc., consulting engineers of Pittsburgh, resigning in 1920 when he became chief engineer of the Bureau of Engineering, Department of Public Works, City of Pittsburgh. In 1922, he established a private practice, which he discontinued upon being appointed assistant director of the newly organized Department of Public Works of Allegheny County. He continued in this position for two years, having general supervision of planning and designing a major program of road, boulevard, and bridge improvements, including a modern county road system for Allegheny County.

In 1926 Mr. Reppert became chief engineer of the Department of Public Works of the City of Pittsburgh and during the next ten years had general supervision of all public-work improvements, including major boulevard and street projects, the rehabilitation and improvement of the water-works systems, bridge construction and reconstruction, trunk sewer design and construction, and other engineering activities of the city.

He is now practicing as a civil engineer in Pittsburgh, specializing in the design and supervision of construction of industrial and building projects. In 1936 he served in a supervisory capacity on the completion of the new building of the Mellon Institute of Industrial Research and, at the present time, is engaged in supervising the design and construction of the engineering features of an extensive low-cost housing project at Clairton, Pa., which is being constructed to meet the need for industrial housing.

Mr. Reppert became a member of the Society in 1912 and is at present serving as president of the Pittsburgh Section of the Society. He also served for three years on the Society's Licensing Committee. He is a member of the Engineers Society of Western Pennsylvania, and of the Duquesne Club of Pittsburgh, and a former president of the American Society of Municipal Engineers (now the American Public Works Association).

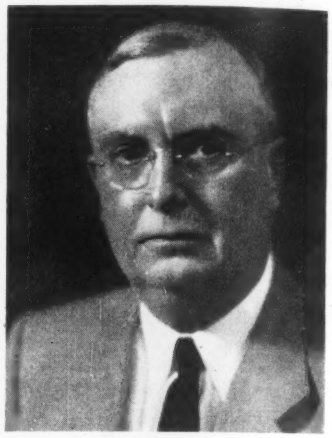
JAMES L. FEREBEE

JAMES L. FEREBEE was born in Camden County, N.C., on December 3, 1880. He received his early education in public and private schools and graduated from the North Carolina State College in 1902, receiving the degree of bachelor of engineering.

From 1902 to 1904 he was with the Durham and Charlotte Railroad Company, and during 1905 and 1906 he was engineer-surveyor for the John L. Roper Lumber Company and the Roanoke Railroad and Lumber Company, both of Norfolk, Va. Following this, he was employed until 1909 as assistant engineer in the Water Department of the City of Wilmington, Del. After a year as contractor for highway work in New York State, he returned for a year to the Wilmington Water Department. Beginning in 1910, he was employed by the late T. Chalkley Hatton, M. Am. Soc. C.E., consulting engineer of Wilmington, as resident engineer on a storm water drainage system for Atlantic City, N.J.

In 1914 Mr. Hatton assumed the position of chief engineer of the Sewerage Commission of the City of Milwaukee, and in April 1915 Mr. Ferebee joined him in Milwaukee as principal assistant engineer on the design and construction of a complete intercepting sewer system and of one of the early large activated sludge plants.

This engagement continued to 1923 when he formed a construction company and was engaged for three years in constructing tunnels on the extension of the Metropolitan Sewerage System of the County of Milwaukee. Having completed this work, he assumed in 1926 the position of Commissioner of Public Works of the City of West Allis, a part of the Milwaukee Metropolitan Area, doing considerable work in street improvements, storm sewer systems, and the extension of the water-supply system. Simultaneously, from 1928 to 1930, he was a member of the Metropolitan Sewerage Commission of the County of Milwaukee, having been appointed by the governor.



JAMES L. FEREBEE
Nominee for Vice-President,
Zone III

On September 1, 1930, he became chief engineer of this commission and of the Sewerage Commission of the City of Milwaukee, having continued in this capacity since that date. During this period the extension of the sewage disposal plant has been designed and constructed.

On August 12, 1933, he was appointed State Engineer of the Public Works Administration for the State of Wisconsin on leave of absence from his regular work. Later Mr. Ferebee offered his resignation as State Engineer, which was accepted September 15, 1934, and actively resumed his duties as chief engineer of the Sewerage Commission and the Metropolitan Commission.

He was active in working for a licensing law for architects and professional engineers in Wisconsin. In September 1931 he was appointed a member of the Board of Examiners of Architects and Civil Engineers (now the Wisconsin Registration Board for Architects and Professional Engineers) and has been continuously a member of this board since its creation, being chairman of the Professional Engineering Division. He has also served as director and president of the National Council of State Boards of Engineering Examiners.

Mr. Ferebee became an Associate Member of the Society in 1915 and a Member in 1919. From 1935 to 1937 he served as Director. He has also been active in the affairs of the Milwaukee Section of the Society (now the Wisconsin Section), of which he is a former president. He is a member of the Milwaukee Engineers' Society, the Professional Men's Club, the Central States Sewage Works Association, the American Society of Municipal Engineers, and the American Society of Military Engineers.

HAROLD W. HUDSON

HAROLD W. HUDSON was born in Pittsburgh, Pa., and received his technical education at the University of Minnesota. Upon leaving college, he was engaged for several years on railroad location surveys and construction in Colorado and various sections of the Southwest. His early experience also covered the construction of the Tampico (Mexico) Wharf in 1900.

In 1903 he became associated with the engineering department of the Pennsylvania Railroad and, during the construction of that railroad's entrance into New York City, was assigned on the construction of the passenger terminal facilities on Long Island. Later, he was placed in charge of the construction of the Hell Gate Arch Bridge and approaches for the New York Connecting Railroad in New York City, the work being completed coincident with the United States' entry into the World War. Colonel Hudson, who at that time held the rank of captain in the Engineers' Reserve Corps, was called into active military service in April 1917, was assigned to the 11th Engineers, and went to France with that unit. Later, he became chief engineer of the Transportation Corps on the staff of the Director General of Transportation, A.E.F., with the rank of lieutenant colonel. He received a citation from the Commander-in-Chief, A.E.F., and was awarded the Purple Heart, U. S. Army, and the French Legion of Honor.

Upon his return to the United States in 1919, he engaged in consulting practice until 1921, when he became chief engineer of a short-line railroad operating in the coal regions of Viriginia. Upon completing this work, he was in charge of all field engineering and construction forces on the electrification of the Virginian Railway, involving a large steam generating station, cross-country transmission line, substations, and catenary system. When this work was accomplished in 1926, he took charge of the electrification of the Bay Ridge Division of the Long Island Railroad and, later, became associated with the New Jersey State Highway Department in the construction of the express highway extending westward from the Holland Tunnel. This involved the location, design, and construction of the "Pulaski Skyway," extending from Jersey City to Newark. When this highway was opened to traffic in 1932, he became Assistant State Highway Engineer and remained in that capacity until 1934, when he accepted appointment in charge of the construction of the Triborough Bridge and connections in New York City. Since the completion of that structure in 1936, he has been in charge of the construction of the Bronx-Whitestone Bridge and connections for the Triborough Bridge Authority.

Harold W. Hudson
Nominee for Director, District 1

In addition to being a Member of the Society, Colonel Hudson is a member of the American Institute of Consulting Engineers, the American Railway Engineering Association, the Society of American Military Engineers, and the Military Order of Foreign Wars. He is a former president of the Metropolitan Section, and has served on the Executive Committee of the Construction Division of the Society.

Harold M. Lewis

Harold M. Lewis was born at Red Hook, N.Y., on August 8, 1889. He graduated from Williams College with an A.B. degree in 1909 and from Rensselaer Polytechnic Institute with a C.E. degree in 1912. The first three years of his professional experience were spent in the design and construction of water supply and sewerage systems while in the employ of various engineering firms in New York, St. Louis, and Germany. He then spent three years in the employ of Charles W. Leavitt, consulting civil and landscape engineer of New York City, and was resident engineer for him in charge of extensive improvements constructed by Charles M. Schwab at his summer home in Loretto, Pa. During the World War he spent over two years as an officer in the U. S. Engineer Corps, serving for nineteen months in the A. E. F.

Since 1921 Mr. Lewis has been in the city planning field—first as executive engineer for the Committee on a Regional Plan of New York and its Environs, and since 1932 as engineer of the Regional Plan Association, now having the title of chief engineer and secretary of that organization. During this time he has been in charge of all engineering and planning studies connected with the development of the regional plan. He was author of several of the reports published by the Regional Plan Committee, including the volumes on *Highway Traffic, Transit and Transportation,* and *Physical Conditions and Public Services,* and was assistant author of the report entitled *The Building of the City.*

Harold M. Lewis
Nominee for Director, District 1

Since 1929 he has also practiced as consulting engineer, serving in that capacity for the Bayonne City Plan Commission from 1929 to 1931, the Planning Board of Montclair, N.J., since 1931, and other municipalities. He has been a consultant to the National Resources Committee since 1935. He has served as a member of the following mayors' committees in New York City: Committee on Plan and Survey, 1926 to 1928; Advisory Board on City Planning, 1933; Committee on City Planning, 1934 to 1937; and Committee on Traffic Problems, 1937. In 1938 he lectured on engineering aspects of city planning at Columbia University.

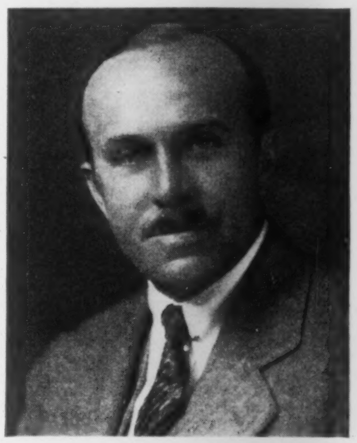
Mr. Lewis became a Junior in the Society in 1913 and was elected an Associate Member in 1916 and a Member in 1922. He has been active in the affairs of the Metropolitan Section of the Society, having served as secretary from 1922 to 1926 and later as director and vice-president. He served as secretary of the Executive Committee of the City Planning Division of the Society from 1929 to 1934 and for the past three years has been chairman of that committee. He is a licensed professional engineer in both New York and New Jersey, a member and former president of the Society of Terminal Engineers, and a member of the American City Planning Institute, American Planning and Civic Association, Society of Planning Officials, Phi Beta Kappa, Sigma Xi, and Tau Beta Pi.

Sanford W. Sawin

Sanford W. Sawin was born in Wilmington, Del., on November 4, 1881. He received his education in the public school system of Wilmington and graduated from the University of Delaware in 1903, with the degree of bachelor of science in civil engineering.

From the time of his graduation until 1909 Mr. Sawin was engaged in railroad construction and maintenance with the Pennsylvania Railroad and the Norfolk and Western Railway. From 1909 to 1913 he was employed in blast furnace and ore handling design and construction in the United States and Canada. From 1913 to 1914 he was superintendent of railroad construction for the John S. Metcalf Company, of Montreal, Canada.

In 1915—after a year in structural steel design—he joined the staff of E. I. du Pont de Nemours and Company, of Wilmington, Del., where he has remained for the past twenty-three years. During this period he has served in various engineering capacities and at present is project engineer assigned to the Fabrics and Finishes Department handling plant design.



Sanford W. Sawin
Nominee for Director, District 4

Mr. Sawin became an Associate Member of the Society in 1919 and a Member in 1930. He has long been active in the affairs of the Philadelphia Section of the Society, having served as director in 1929 and 1930, as vice-president from 1931 to 1933, and president in 1933 and 1934. Mr. Sawin is also a member of the American Institute of Chemical Engineers.

Charles T. Leeds

Charles T. Leeds was born in Newton, Mass., on May 14, 1879. He attended the Massachusetts Institute of Technology and the U. S. Military Academy at West Point, graduating from the latter in 1903 with the commission of 2d lieutenant in the Corps of Engineers. He returned to the Massachusetts Institute of Technology later for special studies and received the degree of bachelor of science in 1906.

During 1903 and 1904 he served in the Philippines, where he was engaged in exploration, road construction, and port development. He then returned to the United States for service with the Corps of Engineers troops from 1905 to 1908. In the latter year he was assigned to the post of assistant to the U. S. District Engineer at Los Angeles, Calif. In 1911 he was promoted to the rank of cap-

CHARLES T. LEEDS
Nominee for Director, District 11

tain, Corps of Engineers, U. S. Army. From 1909 to 1912 he was U. S. District Engineer at Los Angeles, in charge of all fortification construction, and river and harbor improvement south of Monterey, Calif., including the Colorado River drainage basin. During this period he had charge of the construction of the San Pedro and San Luis Obispo breakwaters and also served as a member of the California Debris Commission. In 1912 he was retired for physical disability incurred in line of duty.

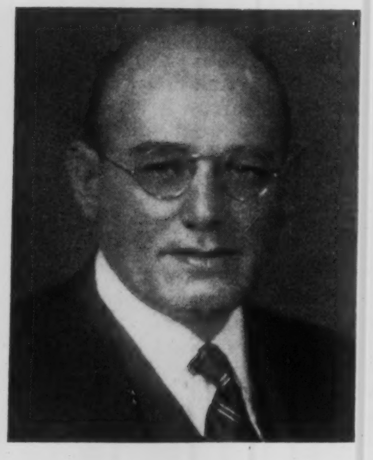
In 1912 Mr. Leeds formed a partnership with the late Wilfred K. Barnard, M. Am. Soc. C.E., which continued until 1930, when it was consolidated with the firm of Quinton, Code & Hill, forming the present firm of Quinton, Code, Hill, Leeds & Barnard. From then until the present—except from 1917 to 1919, when he again served as U. S. District Engineer in charge of Los Angeles District and, also, as professor of military science and tactics at California Institute of Technology—he has practiced civil engineering extensively, specializing in water supply, harbor engineering, and seacoast problems. At the present time he is Advisory Engineer on Seacoast Protection for the State of California. He has served as consultant on many water-supply, flood-control, dam, and tunnel problems for various political subdivisions of the State of California, and in 1931 he was called to Puerto Rico by the Insular Government for consultation on port problems.

In 1918 he was promoted to the rank of major, Corps of Engineers, U. S. Army, and became a lieutenant colonel, Engineers Reserve Corps, in 1925.

Mr. Leeds was active in the organization of the Los Angeles Section of the Society and served as its vice-president in 1914 and its president in 1915. For several years he has been a member of the Committee on Timber Piles and Construction Timbers of the Waterways Division of the Society. He is a member of the Society of American Military Engineers, the American Association of Port Authorities, the Society of Terminal Engineers, the American Geophysical Union, the Seehafenbau Technische Gesellschaft, and the International Association of Navigation Congresses, and is a registered civil engineer in the state of California.

ROBERT B. BROOKS

ROBERT B. BROOKS was born in Jackson, Tenn., on March 17, 1887. He graduated from Washington University with the degree of bachelor of science in civil engineering in 1910, and was awarded the honorary professional degree of C.E. by this university in 1922. In 1910 and 1911 he was employed as rodman, inspector, and assistant concrete engineer for the St. Louis and San Francisco Railroad, and later was assistant engineer of construction for the Department of Sewers for the City of St. Louis.



ROBERT B. BROOKS
Nominee for Director, District 14

In 1913 Mr. Brooks organized the partnership of Brooks & Burkham (later Moreno, Brooks & Burkham), which constructed sewers, water lines, miscellaneous municipal structures, and highways in many states. At the outbreak of the war he resigned and enlisted in the Army, serving as a commissioned officer in the Construction Division. After the war he again entered construction work with Messrs. Moreno and Burkham, specializing in the construction of highways and municipal sanitation projects. In 1922 this firm built the largest highway project in Missouri, consisting of 28 miles on U. S. Highway 40 from St. Charles to Foristel, Mo., at a cost of approximately $1,000,000.

In 1925 Mr. Brooks was appointed director of streets and sewers for the City of St. Louis. During his administration the collection of garbage by motor was initiated, and under his direction bond issue funds for repairs on main trunk sewers were judiciously expended. He substituted power flushing for sprinkling streets, which saved $400,000 a year in special direct sprinkling tax. He was a member of the City Plan Commission and the Regional Plan Commission, and of the Board of Public Service, which had jurisdiction over the major expenditures of an $87,000,000 bond issue.

In 1931 he was sent by the International Association of Public Works Officials to represent this organization at the First International Conference on Public Cleansing held in London, England, and prepared this country's contribution. He was elected to and is a member of the International Executive Committee which represents 20 countries.

In 1936 the Mexican government invited Mr. Brooks as one of three civilian engineers to accompany the Mexican cabinet and international officials in dedicating that section of the inter-American highway extending from Laredo, Tex., to Mexico City, on which highway he had from time to time advised the Mexican engineers. In May of this year he was appointed by the Secretary of State as a delegate from the United States to the Eighth International Road Congress held at the Hague, Holland.

He is a member of the Missouri State Highway Commission and of the Board of Directors and the Executive Committee of the American Road Builders' Association, and a former president of the International Association of Street Sanitation Officials. He is also a member of the Board of Directors of the Municipal Theatre Association of St. Louis and a member of the Engineers Club of St. Louis and of the Missouri Athletic Association.

Mr. Brooks joined the Society in 1921 as an Associate Member, and in 1924 became a Member. He has contributed various technical articles on highways and municipal sanitation to the Society publications as well as other technical societies and magazines.

EDWARD S. BRES

EDWARD S. BRES was born and reared in New Orleans. After receiving his primary education in private schools, he entered Tulane University, where he was graduated in 1910 with the degree of bachelor of engineering in civil engineering. In 1931 he received the advanced degree of civil engineer. Following graduation, he was for several years in responsible charge of engineering projects in the development of the Port of New Orleans, the Mississippi River and its tributaries, and in highway construction, then in its initial stages of development in Louisiana.

EDWARD S. BRES
Nominee for Director, District 15

In 1917 Mr. Bres entered the first Officers Training Camp and was commissioned a first lieutenant in the Corps of Engineers. His two years of service in the Army included the training of troops and duty with the 1st Army Corps, A.E.F., in the Meuse-Argonne offensive in France.

Since 1919 he has practiced civil engineering, and since 1924 has been a member of the contracting engineering firm of Scott & Bres. His main work has been in connection with harbor and dock improvement, stream control, and foundations.

Mr. Bres has been active in matters of national defense, having served in the Reserve Officers Association, as president of the New Orleans Chapter of the Louisiana Department and of the IV Corps Area, and as vice-president of the national organization. In the Reserve Corps he is commissioned colonel, Corps of Engineers and commands the 312th Engineers (Combat) as division engineer 87th Division.

Mr. Bres was elected an Associate Member of the Society in 1917 and a Member in 1925. In the latter year he served as president of the Louisiana Section of the Society. Later, as chairman of the Aims and Activities Committee of the Section, he was instrumental in establishing annual Section awards of Junior membership in the Society to the outstanding graduate of Tulane University and Louisiana State University. He also assisted in the establishment of the Tulane University Student Chapter of the Society and has served continuously as its Contact Member.

Representing the Louisiana Section, Mr. Bres served as chairman of the Louisiana Committee for Trade Recovery in 1932 and 1933, and the projects reported by this committee have been used as a basis for ERA, CWA, WPA, and PWA work in Louisiana. In 1935 he served as president of the Louisiana Engineering Society and, also, as a member of the WPA Soil and Foundation Survey Board, organized to supervise a study of the soil and foundation conditions in and around New Orleans.

In 1936 Mr. Bres was a representative for Regional District No. 5 on the American Engineering Council and since that time has served as representative of the Louisiana Engineering Society on the Council. Serving on committees concerned with the adequate registration of professional engineers, he has often appeared before the state legislature advocating this measure.

Mr. Bres is a member of the Louisiana Engineering Society and the Society of American Military Engineers. His clubs are the Boston Club and the Army and Navy Club.

Amendments to By-Laws—"Article IV. Committees"

Committee on Research Abolished; Committee on Professional Objectives Established

Two amendments to Article IV of the By-Laws, which refers to committees, were unanimously adopted by the Board of Direction in session at Rochester, N.Y., on October 10, 1938. The first abolishes the Committee on Research and the second establishes the Committee on Professional Objectives.

It will be recalled that the latter committee was authorized by the Board at Salt Lake City on July 17, and that on July 18 the way was opened for the present action in regard to it by another amendment to Article IV of the By-Laws, abolishing the Committee on Professional Activities (see Civil Engineering for September, pages 619 and 620).

The first amendment of October 10 strikes out the last paragraph of Section 1 of Article IV dealing with the administration of Society committees and substitutes the following:

"The Board may appoint other Committees from time to time from its own membership or otherwise. Such Committees shall be grouped as may be desired into two Departments, Administrative or Professional. All Committees so appointed shall report directly to the Board, and shall perform their duties under its supervision. Research committees shall report through the respective Divisions."

It also amends Section 10* to conform with the new administrative set-up, so that it will read as follows:

"10. The Technical Department shall consist of Technical Divisions, their Committees, and the Committee on Technical Procedure.

"(a) Technical Divisions: Each Division shall have an Executive Committee, as provided in Article VIII, Section 3 of these By-Laws. It shall be the duty of the Technical Division Executive Committees, each for its own technical field, to arrange technical sessions at the Society's meetings and to appoint and supervise committees set up for administration of the Division and for technical and research purposes. All Division committees other than administrative committees shall be under obligation to cause their work to result in written reports of such quality as to warrant inclusion in the Society's publications.

"The terms of the Executive Committee members shall be five years, one to cease annually. There shall be a Chairman and a Vice-Chairman.

"(b) The Committee on Technical Procedure shall consist of the Chairmen of the Technical Divisions of the Society; the Chairman of the Committee on Publications; two other members of the Board of Direction; and the President and Secretary of the Society. The Secretary of the Society shall act as Secretary to the Committee.

"It is the function of the Committee to effect coordination of all the technical activities of the Society, and to make recommendations to the Board of Direction in regard to technical activities whenever such action appears to be advisable."

The second amendment of October 9 applies to Section 9* of Article IV. It adds to the list of committees in the Professional Department the name of the Committee on Professional Objectives, so that the list of committees will read as follows:

"Committee on Engineering Education
Committee on Public Information
Committee on Registration of Engineers
Committee on Fees
Committee on Salaries
Committee on Professional Objectives"

It also adds to Section 9* a new paragraph, after paragraph (*e*), as follows:

"(*f*) The Committee on Professional Objectives shall consist of three Board members and four non-Board members appointed at the outset for terms of one, two, and three years, and thereafter for three-year terms. It shall recommend, and upon approval, shall put into effect, methods and procedures calculated to encourage the discussion of problems of a general professional nature, public relations, social responsibilities of the engineer, the development and maintenance of high standards of practice and ethics; thus to increase the usefulness of the profession to society. This Committee shall function as an agency through which both salaried and employer engineers may express themselves more fully and effectively on professional matters, and shall give particular consideration to the economic and social status of the engineer."

Both of these amendments were adopted following notice given at the July meeting of the Board of Direction, in Salt Lake City, and in accordance with constitutional requirements.

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* Readers referring to the current Year Book will find the Sections referred to here as 10 and 9, appearing as 11 and 10, respectively. The change in numbering was effected by the amendment adopted in July and reported on page 619 of the September issue.

New Officers of Engineering Foundation

Frank Malcolm Farmer, vice-president and chief engineer of the Electrical Testing Laboratories, New York, has been reelected chairman of the Engineering Foundation, research organization whose activities are reported elsewhere in this issue. The election is for the fiscal year ending in October 1939. George E Beggs, M. Am. Soc. C.E., professor of civil engineering at Princeton University, was elected vice-chairman. J. H. R. Arms will continue as secretary, and Otis E. Hovey, Hon. M. Am. Soc. C.E., as director.

The executive committee is headed by Mr. Farmer. The other members of this committee are A. L. J. Queneau, metallurgist for the U. S. Steel Corporation, New York; Prof. W. I. Slichter, of Columbia University; K. H. Condit, of the National Industrial Conference Board, New York; and Professor Beggs.

Those elected to the Engineering Foundation Board were E. M. T. Ryder, M. Am. Soc. C.E., way engineer for the Third Avenue Railroad, New York; F. F. Colcord, vice-president of the U. S. Smelting, Refining and Mining Company, New York; O. E. Buckley, executive vice-president of the Bell Telephone Laboratories, New York; and Mr. Queneau.

Mr. Colcord will serve as chairman of the Research Procedure Committee; Prof. George B. Waterhouse, of the Massachusetts Institute of Technology, will be chairman of the Iron Alloys Committee; and Comfort A. Adams, M. Am. Soc. C.E., consulting engineer for the E. G. Budd Manufacturing Company of Philadelphia, of the Welding Research Committee.

Mr. Hovey was elected the Foundation's representative on the Highway Research Board to succeed the late Alfred E. Flinn, M. Am. Soc. C.E., and Mr. Farmer will represent the Foundation on the executive committee of the National Research Council.

Northern Conference of Local Sections

Rochester Section Is Host to Enthusiastic Forum; Society's Part in Advancing the Engineering Profession and Improving the Economic Status of Its Members Is Discussed

ON TUESDAY, October 11, 1938, representatives from the Local Sections in the Northern Meeting Region gathered together in the Seneca Hotel at Rochester, N.Y., for an intimate and frank discussion of many professional problems now before the Society. In all, 28 Sections were represented at the all-day conference, including Kansas on the west, Kentucky on the south, down-east Boston, and all Sections in between.

Following a warm welcome to the visiting Local Section officers by President W. H. Roberts of the Rochester Section, E. B. Black, chairman of the conference and of the Local Sections Committee under whose guidance it was conducted, plunged into the agenda which had been carefully prepared and placed in the hands of each representative in advance. All topics on the agenda had been specifically assigned weeks before to some Section officer for presentation within the five-minute period allowed him.

Highlights of the Conference of Local Sections in the Northern Meeting Region, held at Rochester on October 11, are presented here, and an abstract of an address on one topic of special interest—"Local Section Administration"—appears elsewhere in the Society Affairs section.

The Conference program centered around the same subjects as were discussed at the earlier 1938 conferences in other Meeting Regions—at Jacksonville (April 18) and at Salt Lake City (July 19). A complete record of the Conference will be forwarded on request to members as long as the edition lasts.

RATING OF ENGINEERING DEPARTMENTS DISCUSSED

In presenting the subject of "Rating Engineering Departments and Offices in Cities, Counties, and States with Regard to Salaries Paid and Professional Qualifications Required," Paul Holmes, president of the Central Ohio Section, said:

"Within the confines of any one state, conditions ordinarily exist whereby the remuneration of any particular grade should vary between definite limits. Unfortunately, in prescribing an upper and lower limit, the lower limit is usually accepted as the maximum, to the complete exclusion of the maximum rate established." He said that the ten grades as set up in the report of the Society's Committee on Salaries are accepted as a basis for comparison in the State of Ohio, but while the salaries in the lower grades in Ohio agree substantially with the committee's schedule, those in the upper grades are substantially lower.

The salaries paid to city engineers in the smaller cities of Wisconsin vary enormously, according to Lloyd D. Knapp, secretary of the Wisconsin Section. He stressed the desirability for a more definite classification of positions and duties in the salary schedule. In Indiana, according to a recent survey reported by K. B. Wolfskill, assistant secretary of the Indiana Section, highway department salaries are from 15 to 35 per cent lower than in the highway departments of 13 surrounding states. As a result, unionization of engineers is receiving more attention than a year ago. R. L. McNamee, president of the Michigan Section, reported that unionization is not a serious threat in the civil branch of the profession although it has made some progress in the automotive branch. Civil service has just gone into effect in Michigan within the year and better classification of positions is anticipated. Section officers from Duluth and Cleveland reported that the local attitude of engineers toward unionization is favorable when and where salaries are inadequate.

Speaking of the unionization of engineers in some parts of the United States under the provisions of the Wagner Act, William C. E. Becker, president of the St. Louis Section, said:

"I am inclined to believe that professional engineers as well as all other technical engineering employees are included. The engineering profession would prefer to be excluded entirely from the provisions of the Act. This could be done most effectively by amending the definition of an 'employee' to exclude any engineer qualified to practice professional engineering as defined in the Model Registration Law. Some thought should be given to soliciting the interest of organizations representing other professions to the end that all professional service be excluded."

ENCOURAGING APPLICATIONS FOR MEMBERSHIP

In a concise, carefully phrased paper, Admiral R. E. Bakenhus, president of the Metropolitan Section, approached the subject of "Appropriate Methods of Encouraging Applications for Membership by Qualified Engineers" by considering one after the other what advantages the Society has to offer to prospective members—its publications, its meetings, its Technical Divisions, its Local Sections, its committees engaged on research, its professional committees, its disinterested service in public affairs, its Student Chapters, its work to regulate the practice of civil engineering, and to obtain fair and proper emoluments and conditions of service for those who practice. He outlined methods he believed appropriate and proper for individual members to place the matter of membership before engineers in whom they have confidence and whose ability they respect.

President J. Gardner Bennett, of the Illinois Section, outlined steps that are being taken in Chicago and other cities in Illinois to acquaint qualified engineers with the mutual advantages of membership. Secretary William E. Hawley, of the Duluth Section, stressed the value of Student Chapters in acquainting young engineers with the technical work the Society is doing. Prof. William R. Benford, chairman of the Providence Section, has a committee which is quietly at work talking the advantages of group action in professional matters to engineers of corporate-grade qualifications. "A single individual, no matter how talented or determined, will not get very far," he said, "but organized engineers, such as the Society, will generally attain their objective." He pointed out in this connection the need for joint meetings of each Local Section with the Student Chapters in its area and the necessity for frequent visits by members and Society officers to Student Chapters.

Dr. Lorenz Straub, president of the Northwestern Section, told of the fine results obtained by his committee on membership in issuing written invitations to non-members to attend special meetings of the Section. The Pittsburgh Section held an open meeting last year to which were invited by personal contact and by letter a selected number of non-member engineers in municipal and corporation employ, President C. M. Reppert related. This brought the Society before a group of men in Pittsburgh who were not before familiar with the Society.

In answer to a number of questions raised during this part of the discussion, Director R. A. Hill, chairman of the Membership Qualifications Committee of the Board, discussed the qualifications of the various grades of membership and made a detailed explanation of the Society's election procedure.

LOCAL SECTION ADMINISTRATION

"The success of a Local Section is dependent on the interest and activities of those selected to lead it; their ability to inspire others to increased interest and a willingness to take part," said Secretary William M. Spann, of Kansas City. "Our Section's officers are assigned definite duties as the heads of important committees, whose personnel is selected only from those who are willing to serve." (Mr. Spann's paper appears elsewhere in this issue.)

Half of the Kentucky Section's membership of 81 is resident in Louisville; the rest are scattered in 23 other small communities in a state 600 miles across. Secretary Wallace Sanders explained their system of shifting the meetings to different cities and the selection of Section officers from different parts of the state in spite of some inconvenience in administration.

According to C. H. Stephens, secretary of the Dayton Section, which has but 34 members, joint meetings are held each year between that Section and the Cincinnati Section with the Student Chapters at the University of Dayton and the University of Cincinnati. These meetings have done much to create good fellowship and bring the engineers in the cities closer together. "The many bulletins and communications coming from the Secretary of the Society engage the Section's membership in beneficial discussion," he said

Experience with committees in the recently formed Mid-Missouri Section, which covers a large area, leads Secretary R. W. Brooks to state, "Each committee should be localized as much as possible so the members can get together to do some work." He said that interest in the Society had increased a great deal in this part of the state since the formation of the Section there. President P. W. McDonnell has appointed a program committee of six men for the Toledo Section. Under the direction and leadership of the chairman, each of the five members has the responsibility for planning and producing a program for one of the five meetings held. This committee was carefully chosen to produce good programs, and the plan has worked well.

President Bakenhus of the Metropolitan Section presented some of the administrative problems of the Metropolitan Section with its 2,400 members, of which 1,000 are active; its meeting attendances of 250 to 500. Ten committees keep the Section's Board of Directors advised on vital matters, arrange programs, and watch legislation that needs action.

A Comment on Engineers' Salaries, from the Local Sections Conference

"It will require a united front on the part of the profession, with constant pressure, to enhance the economic and social status of engineers. To take such a stand in a dignified way requires self-confidence on the part of the profession and a belief by all concerned, especially those in responsible positions, in the high value of the profession to the community."

—R. E. Bakenhus, President of the Metropolitan Section

Local Section Publicity Appraised

The Rochester Section is planning a bi-weekly news sheet of the Section and its members to be run by younger members, according to A. R. Reilly, secretary-treasurer. Secretary Francis H. Kingsbury explained that the Northeastern Section had selected one of its own members to carry on its outside publicity, and President Roscoe Suttie of the Connecticut Section has named a member with a flair for newspaper writing as a publicity contact man. In the state of Kansas an energetic Junior, Milbern H. Davison, has been functioning for the past two years with considerable success in the dual capacity of correspondent for the publications of the Society—personal items, Section activities, and technical articles—and of reporter of Section and Society activities for Kansas newspapers.

"Sections in a large city, as the Metropolitan Section, find it an extremely difficult matter to get desirable publicity into the great dailies. Undesirable publicity is easy," said President Bakenhus. "The problem of educating the taste of the public to care for worthwhile news rather than sensational items is involved."

In a brief talk, the Society's Publicity Director, George A. Miller, stated that engineers should learn to talk about themselves and their work in an interesting way. Civil engineers are largely responsible for the expenditure of taxpayers' money. Taxpayers are entitled to know this fact and that it takes civil engineers to build the roads, to irrigate the land, to transport all food; that civil engineers collect the water and bring it to the city; that civil engineers dispose of the sewage and can turn the water back into a river clear and pure enough for human consumption. Such facts, obvious to an engineer, have news value to the newspaper editor because they may be translated into human needs.

The afternoon session of the conference was addressed by Dr. Henry E. Riggs, President of the Society, on the importance of the Local Sections in the administration of the many affairs of the Society. He pointed out the great stimulation in growth the Society enjoyed after the organization of Local Sections. To handle such problems as legislation, registration, unionization, and assistance to young engineers "we must develop each Local Section into a strong, active body of high-grade engineers willing to cooperate with all the other technical societies in the state," he said. "There has been no notable change in the sentiment of the Board in the past 25 or 30 years regarding membership. We ought to bring into the Society the strong, able, high-grade engineers in each community and keep out those who are technically disqualified, those who are not good citizens, who are dishonest and unethical."

Improving Economic Status of Young Engineers

President R. L. Whannel, of the Central Illinois Section, presented as his thesis that students of civil engineering should be encouraged strongly to become Juniors immediately upon graduation in order to maintain and develop knowledge of their chosen profession; that the Society's Employment Service should be fully explained at Student Chapter meetings and its services made more easily available to them; and that older engineers should not sidestep any opportunity to guide the young engineers into satisfactory placements. He suggested that each Section administer a placement agency.

Discussion of this subject was led by Nelson Stone, treasurer of the Buffalo Section. "It seems that we have taken for granted that the young engineer is suffering from a very poor economic situation," he said. "Whether this is true or not can only be brought out by a national survey." He gave encouragement to the idea expressed by Mr. Whannel as to the formation of placement committees in Local Sections.

Vice-President W. W. Carlton of the Cincinnati Section set forth the desirability of a higher educational standard for engineers. He said, "With the passing of our generation, the nontechnically trained engineer will have ceased to exist. Boards of registration and the increasing ease with which a college education may be obtained will take care of that. It seems highly probable that within a few years the four-year course for engineers will have become a matter of history, and that two years of comprehensive study in all the fields of human knowledge will be required before a man can pursue a professional career."

The Cleveland Section's secretary, G. Brooks Earnest, suggested that the Society delegate to Local Sections the problem of cooperating with government agencies in setting up and maintaining salaries recommended for that geographical area by the Society's Committee on Salaries. For the past five years the Cleveland Section and the Student Chapter at the Case School of Applied Science have enjoyed a close relationship that has made it possible for graduates to obtain better positions.

"The Pittsburgh Section has just announced a Contact Service to provide a ready means of contact between Juniors looking for engineering jobs and Section members needing engineers. Any Junior may file a record card and members of the Section who require engineering help or who may be aware of openings are expected to make their needs known to the Contact Service. The Junior who appears to qualify for an opening will be notified to make his own application. No charge is to be made for the service of this clearing house of confidential information which is available only to members of the Section," explained President C. M. Reppert.

Speaking for the Philadelphia Section, C. E. Myers, past-president of the Section and Director of the Society, explained how it is that practically all the Juniors in the Section know all the older members. "We encourage fellowship in our Section. Three times each year the board of the Section picks out a Junior for each corporate member to invite to dinner the night of the meeting, to take charge of all through the evening, and to introduce to his friends."

Making the Committee on Professional Objectives Effective

Because of the recent appointment by President Riggs of the personnel of the Committee on Professional Objectives, the chairman, Enoch R. Needles, was asked to introduce the subject of how to make this committee's operations most effective. "In recent years our thinking has crystallized around the viewpoint that our Society might well become a little less a practical school and a technical society, and be a little more responsive to the individual members. The desire to see this come about and the discussions which have taken place with regard to it have finally resulted in the creation of this committee. Through this committee it is possible that the strength of the Society and perhaps the experience of the committee's members in dealing with problems of this character may be utilized to help out Local Section groups at times when such help is needed." In leading the discussion of this topic, G. Reed Shaw, secretary of the newly organized Mohawk-Hudson Section, suggested "the establishment in each Local Section of a similar local committee acting within the Section as a fact-finding agency, each to submit its data to the Society committee."

With the thought that what other engineering societies are doing must inevitably have a bearing on the answer to the question of making the Society Committee on Professional Objectives most effective, Secretary R. B. Kittredge, of the Iowa Section, outlined briefly what is being done by the Iowa Engineering Society to organize a Professional Division. Following a discussion of the relation between engineers and labor organizations at a recent Iowa Engineering Society's meeting, a committee of 15, representing many branches of engineering, was appointed to report. It recommended on March 22 this year that "the Iowa Engineering Society hire a competent and qualified man to take charge of the organization of a Division of the Society, to the end that the professional engineers of Iowa should belong to an organization of such nature that it can aid in stabilizing the tenure of service of engineers and their assistants, promote better appreciation of the value of engineering service to employees and the public, and afford an agency for collective bargaining if that need arises." A managing director has been employed and to date 500 men have signed applications for membership in the Professional Division to be established and have agreed to pay $12 annual dues. There were 160 members in the Iowa Engineering Society previously. It is proposed that membership may be held individually in either the Technical Division or the Professional Division or jointly in both. The Professional Division is to concern itself with the ethics, legal status, employment, economic welfare, and employment of its members. This Division, or any local unit of it, is to be recognized and designated by the members as the bargaining agent under any state or national laws pertaining to economic welfare and employment of its members.

According to Dr. Lorenz Straub, president, the Northwestern Section cooperates closely with the Minnesota Federation of Engineers and Architectural Societies which takes active leadership in the state in handling matters relative to legislation and registration. He pointed out that existence of organizations that provide cooperation between individual societies should be considered by the Committee on Professional Objectives in setting up its program.

In the Syracuse area unionization is not a problem even though there is a feeling that the engineer is in a low professional grade, stated M. H. Sturtevant, secretary of the Section. There are local problems of salary, fees, tenure of office, political interference, and corporation black-lists that a small Section cannot handle. "In the Syracuse Section our hands are tied because of the make-up of our membership. No department head feels that he can jeopardize his own position by having his Section initiate moves contrary to the desires of his supervisors. The Society can step in in such places and help Local Sections."

Two members of the Committee on Professional Objectives were present, Director W. W. DeBerard and Prof. Frederic Bass. Each stressed the need for suggestions developed by Local Sections in establishing their committee's program. Constructive comments by Allan T. Dusenbury and J. W. Follin, members of the Committee on Local Sections, closed the conference.

Local Section Administration

By WILLIAM M. SPANN, M. AM. SOC. C.E.
SECRETARY, KANSAS CITY SECTION, KANSAS CITY, MO.

Abstract of Address at the Local Sections Conference at Rochester, October 11, 1938

THE By-Laws of the Society, in the Article on Local Sections, contain a clause which requires that a Local Section constitution should state in effect that "The objects to be attained by Local Sections are the advancement of engineering knowledge and practice; the cultivation of friendly relations with all engineers; the maintenance of high professional standards; and cooperation with other engineering societies with a view to promoting the general welfare of the American Society of Civil Engineers and the engineering profession."

With this reason for organization before us, it is our function to so administer the affairs of Local Sections that results obtained are in line with these purposes. Administration means attention to the multitude of details which are necessary for the Section to function smoothly, like a well-oiled machine. Proper relations and contacts must be maintained with all Section members and through Society Headquarters with the membership at large. Simplification of the administrative structure is best secured by reducing the number of operating units and centralizing the planning.

As a rule a professional man finds his reward not merely in the money he earns, but in his love for his work, in its dignity and importance, in his personal independence, in the distinction he achieves because of his skill and intelligence, and in the respect he commands from his colleagues of the same profession. Engineers are usually individualistic in their tastes, are trained to be thoughtful and serious, and as a rule present a problem in administration. No set procedure will solve the trouble. At any meeting you will see group conferences, with some stranger standing by who would like to get acquainted but hesitates to "butt in." An active reception committee to mix with, get acquainted with, and round up the backward members will help any meeting and be appreciated by the individuals themselves.

In local affairs the best men are not always selected as officials. Instead of executive ability we sometimes are guided by personal admiration for a good fellow, and administrative work suffers thereby. Planning and preparation form a large part of an official's duty and some of us neglect the thinking part. Many members of the Society are members simply because it is the thing to do; they wear the emblem but are utterly indifferent when it comes to service or interest in the aims or activities of our Society. The problem of securing the personal interest and activity of our members is a big one. We are looking for a solution if there is one.

The administration of a Local Section is closely linked with many other activities and interests of its members. The successful methods of operating a Section in one locality may be a complete failure in another, because of the personality or individuality of the membership. Success is somewhat dependent on a knowledge of human psychology and the interest that may be developed in various activities by the members. Some will come to meetings for the fellowship they provide; others will not come out unless there is something on the program that they want to hear or see; and of course small audiences are discouraging to officers and speakers alike. After a discouraging experience of this kind we are endeavoring to increase our attendance by personal contact through an attendance committee and by making the programs of more general interest, more attractive, more timely and entertaining.

In searching for an idea to improve or create interest, to get our members out to meetings, and to take an active part in the Section's work, we might take a tip from some of the other technical societies and have a national speakers bureau, whereby men of prominence could be obtained for local meetings. That would call for regularly scheduled meetings, which I think should be a requirement in all Sections. If meetings are scheduled ahead, arrangements can be made by men who travel to be home on the dates set for the meetings.

Officers of the Kansas City Section are assigned definite duties as the heads of important committees, and the committee personnel is selected only from those who are willing to serve. The Section uses two main committees at this time—a program committee which arranges and handles the speakers and the entertainment features, and a membership committee which takes care of attendance and reception as well. As a rule the work is actually done by one or two of the committee members.

The organization of a publicity committee is contemplated, with a view to securing more local publicity on civil engineering. Press notices in Kansas City are regulated by the reporters' idea of the news importance of the subject, so usually a Section meeting is lucky to get a small headline in a remote spot. The other technical societies of Kansas City—the Electrical, Mechanical, and Chemical—are uniting with the local Engineers Club to have a joint publication and to join in certain scheduled meetings.

Like any other Board of Directors, the executive board of a Local Section should meet to determine routine or special activities. Open forums should be held so that the members may express their opinions and engage in full discussions. Juniors should be required to take an active part as assistants to Section officers and serve on committees in order to become familiar with the duties and be able to better serve when put in a more responsible position later. Interest should be stimulated in public affairs for we are all a part of our public and political structure. Engineers in Missouri are having a fight on registration. It will require the united efforts of all concerned to get a satisfactory law through the legislature.

Any group requires leadership in both professional and public affairs, and in the case of Local Sections this job is very definitely the duty of the officers elected to administer Section affairs. A public relations committee may help. The success of a Section is dependent on the interest and activities of those selected to lead it, their ability to inspire others to increased interest, a willingness to take part in things of a public nature of vital interest to all, and to work for the objects for which the Section is organized.

Past-President Louis C. Hill

The death of Louis C. Hill, Past-President Am. Soc. C.E., which occurred in Los Angeles, Calif., on November 5, ended a distinguished engineering career. Mr. Hill was born in Ann Arbor, Mich., on February 22, 1865. He was graduated from the University of Michigan in 1886 with the degree of bachelor of science in civil engineering, and in 1890 received the degree of bachelor of science in electrical engineering. In 1911 the University of Michigan conferred upon him the honorary degree of master of engineering.

From 1890 to 1903 Mr. Hill was professor of hydraulics and electrical engineering at the Colorado School of Mines, and from 1903 to 1914 he held, successively, the positions of engineer, project engineer, and supervising engineer in the U. S. Reclamation Service. During this period he was in charge of construction of the Salt River Project (including Roosevelt Dam), the Yuma Project, and projects in New Mexico and Texas. He was also in general charge of the Colorado River basin.

Construction of Roosevelt Dam necessitated building roads through extremely rugged country, construction and operation of a cement mill, and the development of hydroelectric power. Engineers know that this was a unique feat, considering the time and the difficulties involved. Among the works included in the Yuma Project were Laguna Dam, the large inverted siphon under the Colorado River, and canals and levees for flood protection. The Rio Grande project in New Mexico and Texas involved the construction of a series of diversion dams along the Rio Grande, canal systems, drainage works, and the design and initial construction of Elephant Butte Dam.

Mr. Hill entered private practice in March 1914, and from then on was retained as consulting engineer by the U. S. Bureau of Reclamation, then the U. S. Reclamation Service. At the time of his death he was a member of the consulting engineering firm, Quinton, Code and Hill—Leeds and Barnard, of Los Angeles, Calif.

Louis C. Hill, 1865–1938

After he entered private practice he was connected with many engineering projects. Among the more important were Gibraltar Dam, a concrete arch structure on the Santa Ynez River, constructed for the city of Santa Barbara; and Pine Canyon Dam (now Morris Dam), constructed on the San Gabriel River for the city of Pasadena; the Big Tujunga Dam on the Big Tujunga; Bouquet Canyon Dam and various works for the Los Angeles County Flood Control District; and Sutherland and El Capitan dams for the city of San Diego, Calif. He was consulting engineer for the state of California on various dams and consulting engineer on the Yaqui River project in Mexico.

As a member of a board of engineers, Mr. Hill made recommendations to the city of Austin, Tex., on acceptance of plans for building a new dam and for replacing and repairing an old structure that had been destroyed. He was the American member on the commission for the distribution of the waters of the Rio Grande and Colorado rivers, and represented the U. S. Bureau of Reclamation on the consulting board on the Columbia Basin project. He was consulting engineer for the U. S. Indian Service on the construction of the Coolidge Dam on the Gila River in Arizona, and served as consultant to the International Water Commission.

Mr. Hill was also consulting engineer to the Corps of Engineers of the U. S. Army on fourteen dams near Zanesville, Ohio; Conchas Dam on the Canadian River in New Mexico; Tygart Dam in West Virginia; Bluestone Dam near Grafton, W.Va.; Sardis Dam, a hydraulic structure near Vicksburg, Miss.; Fort Peck Dam on the Missouri River in Montana; and the Bonneville Dam and locks and large power plant on the Columbia River near Portland. Finally, he was a member of the board of consulting engineers on Boulder Dam, on Imperial Dam, and on the All-American Canal.

For many years Mr. Hill was active in the affairs of the Society. Elected a Member in 1905, he served as Vice-President in 1928 and 1929, and as President in 1937.

Forecast for December "Proceedings"

The Yellow River Problem

By O. J. Todd, M. Am. Soc. C.E., and Sigurd Eliassen, Assoc. M. Am. Soc. C.E.

A comprehensive statement of the immense and complicated problems involved in the control of the Yellow River in China.

Earthquake Stresses and Dynamical Theory

By the late Leander M. Hoskins, Esq., and John D. Galloway, M. Am. Soc. C.E.

Part I is a simple formulation of the fundamental dynamical principles upon which all special solutions must be based; and Part II is an extension of the theory of the oscillating column to a more general class of cases.

Graphical Analysis Applicable to Arch Dams

By Carl H. Heilbron, Jr., Assoc. M. Am. Soc. C.E., and William H. Saylor, Jun. Am. Soc. C.E.

A detailed step-by-step explanation of a method of analyzing arches, the stresses and deflections being determined with all necessary accuracy, by graphics.

Engineering Geology Problems at Conchas Dam

By Irving B. Crosby, Affiliate Am. Soc. C.E.

A discussion of the strength of the underlying rock formations, in terms useful to the civil engineer.

Simplified Wind-Stress Analysis of Tall Buildings

By Otto Gottschalk, Esq.

A plan for using model experiments in structural analysis, interpreting the deformations by purely geometrical reasoning.

Rigid Frames Without Diagonals (The Vierendeel Truss)

By Louis Baes, Esq.

A simplification of the method of designing, and an argument for adopting, the Vierendeel type of truss.

Traffic Problems in Metropolitan Areas

By Earl J. Reeder, Esq.

A pertinent discussion of problems involved in helping traffic through danger spots, protecting pedestrians, reducing accidents at night, relieving traffic concentration, maintaining optimum speeds to suit each condition, and providing spaces for loading and parking.

U.E.T. Reports Good Year; Library Grows in Resources and Use; Engineering Foundation Active

REVIEWING the fiscal year ending October 27, 1938, United Engineering Trustees, Inc., reports "an optimistic picture of continued stability of our financial portfolio as a whole, practically full occupancy of the Engineering Societies Building, gratifying use of meeting halls, and greater protection of the building."

The building, the report continues, "has stood for thirty years as headquarters of the engineering profession. In these rapidly changing times, few buildings remain useful for so long a period." Its physical condition "has been maintained and during the year extensive deferred mechanical maintenance has been met."

"All space in the building is occupied by Founder Societies or Associates on a cooperative basis, except for the area used in the activities of the corporation and its departments, and that used by the National Research Council—Division of Engineering and Industrial Research. Gratuitous use of meeting rooms has been granted to federal, state, and municipal organizations for military and WPA projects and in cooperation with WPA and the Board of Education of the City of New York, adult education classes in mathematics, languages, and other popular subjects."

As for finances, the portfolio of the corporation has been reviewed by its financial advisers, with the comment that their study "is reassuring evidence of the maintenance of good average quality in this list of bonds" and that in some fields the corporation's position "is even stronger than last year."

During the year, the fifth gift of the late Ambrose Swasey, Hon. M. Am. Soc. C.E., was written onto the books at $86,977.16, bringing his gifts to a total book value of $818,632.91.

What Is U.E.T.?

United Engineering Trustees, Inc., is organized to perform for the Founder Societies certain specific acts which are governed by contracts.

It holds the legal title to certain of the real property of the Founder Societies, including the Engineering Societies Building in New York City.

It maintains and conducts the Engineering Societies Library.

It maintains the Engineering Foundation, which is the joint organization of the Founder Societies for research and closely related activities.

It acts as treasurer for the Engineers' Council for Professional Development.

It is custodian for the John Fritz Medal Fund and the Engineering Societies Employment Service Relief Fund.

Its funds are provided by the Founder Societies and by miscellaneous endowments.

Included in the report of U.E.T. are reports of the Engineering Societies Library and the Engineering Foundation, reviewing their accomplishments during the year.

LIBRARY SERVES ENGINEERS THROUGHOUT THE WORLD

The library's report reveals an increase of 14,041 items in its collection during 1938. Users of the library also increased, by almost 5,000, to a total of 41,950, and it is significant that among this group were thousands who availed themselves of the facilities by mail.

"The steadily growing calls upon us from abroad," says the report, "indicate the widening reputation that the Library is obtaining. They also indicate the general lack of libraries equipped to deal with highly technical questions, and the large opportunity that exists for a library with adequate funds for personnel and books."

Requests for assistance have covered a wide variety of subjects and have come from every part of the earth. "Our aid has been sought to establish the validity of patents, to assist in the preparation of theses and books, and to provide data for the design of machines and buildings. Information has been sent to Arabia, Australia, New Zealand, the Union of South Africa, and to most South American countries, as well as to nearly every state of this country."

The "mail order" business of the library includes book-lending, compilation of bibliographies on special subjects, translating, and preparation of photoprint copies.

MANY RESEARCHES SPONSORED BY FOUNDATION

The Engineering Foundation reports that work on 20 research projects has progressed during the year. These include four sponsored by the Soil Mechanics and Foundations Division of the Society, and five sponsored by the Society's Special Committee on Hydraulic Research. The work in soil mechanics is discussed elsewhere in this issue. A summary of the hydraulic research, all of which is being carried out under the direction of Society members, as indicated, is as follows:

Conversion of Kinetic to Potential Energy in Expanding Conduits (Dr. F. T. Mavis). The tests of a transparent conical expansion $7^{1}/_{2}$ in. long connecting transparent pipes 3 in. and 5 in. in diameter, have been completed, and the tests of sudden expansion are nearly finished. A mass of photographic and statistical data has been collected and is being analyzed, and a report is expected during the coming year.

Traveling Waves on Steep Slopes (Prof. H. A. Thomas). The work has been on a study of traveling waves and bores in a channel of trapezoidal cross-section 92 ft long, with slopes from zero to about 8 deg. The channel is long enough to study whether the traveling waves tend to increase or diminish in height as they travel downstream.

Phenomena of Intersecting Streams (Prof. M. P. O'Brien). The work on open-channel intersections has been suspended for the present and attention is being directed to intersections of closed conduits. It was found that better results could be obtained by this procedure.

Curves in Open Channels (Dr. C. A. Mockmore). Data have been taken on velocity measurements at various sections of the bend of a rectangular section 18 in. wide and of varying depth up to 10 in. These data have been plotted into curves showing the condition of flow. A mathematical analysis of stream lines, angular velocity, and acceleration has been made in accordance with the laws of hydrodynamics.

Sedimentation at the Confluence of Rivers (Dr. Lorenz G. Straub). The data collected in these tests may be classified as follows: (1) study of tractive force and equilibrium slopes for various rates of sand transportation; (2) contour records at the confluence for each series of observations; (3) mechanical analysis of the bed sediment; and (4) records of current patterns at the confluence. A new apparatus has been built at the St. Anthony Falls Hydraulic Laboratory designed to overcome some of the shortcomings of the original experimental set-up.

Other research now under way, of interest to civil engineers, includes the study of plastic flow of concrete that is being conducted at the University of California, the meteorological research (wind direction and velocity) at New York University, and the manifold activities of the welding research committee of the American Institute of Electrical Engineers and the American Welding Society.

The Foundation's report disclosed that about $39,000 was expended during the year for furtherance and support of research. It points out that the relatively small grants made to individual projects seem to "act as catalysts which stimulate the contribution of money, materials, and services by institutions, industry, and individuals, in many cases several times the amounts appropriated by the Foundation."

Last Call for Discarded Cuts

THOSE WISHING to have cuts from Volume VII of CIVIL ENGINEERING—that is, 1937—should notify Society Headquarters before January 2, 1939, on which date all cuts from that volume not previously requested will be destroyed. Preference will be given to the authors of the articles in which the illustrations appear—after that requests will be filled in the order received. (Cuts for the covers and pages of special interest are available only as a loan.) The only charge for cuts will be the cost of forwarding by express or parcel post.

Three Local Sections Have Big Meetings

TWO- AND three-day meetings on convention scale opened the fall season for three Local Sections in the southern part of the country—Texas, Mid-South, and Tennessee Valley.

On October 28 and 29 members of the Mid-South Section held their fall convention at Vicksburg, Miss. The opening session took place Friday afternoon at the Hotel Vicksburg, convention headquarters, with William E. Elam, president of the Section, in the chair.

The speakers heard at this session were L. J. Folse, chairman of the Mississippi State Planning Board Commission; G. H. Matthes and George Clemens, respectively principal engineer and senior engineer for the Mississippi River Commission; N. H. Rector, of the Mississippi State Board of Health; and Paul C. Gauger, vice-president of the Section.

A banquet brought the activities of the first day to an enjoyable conclusion. Following a delicious turkey dinner, an entertaining program of singing and dancing was presented. F. N. Menefee, professor of engineering mechanics at the University of Michigan and guest of the Section, then introduced President Riggs, guest of honor and principal speaker. In his talk Dr. Riggs gave a résumé of the history of the Society, calling attention particularly to the development of the Local Sections and Student Chapters. A pleasant feature of the occasion was the presence of six Student Chapter members from Mississippi State College and five from the University of Mississippi. One of these students—A. A. Cordell, of Mississippi State College—gave a brief talk.

Saturday morning was devoted to a business session and another technical program. The speakers on the latter were H. A. Kroeze, director of sanitary engineering for the Mississippi State Board of Health, and Harley B. Ferguson, president of the Mississippi River Commission. General Ferguson's topic was "Construction and Effects of Cut-Offs on the Mississippi River."

At the close of this session the engineers were taken to the U. S. Waterways Experiment Station for a tour of inspection. Lt. Paul W. Thompson, director of the station, took personal charge of the tour. The visiting ladies, in the meantime, were entertained at a bridge luncheon by the wives of local members.

TEXAS SECTION HAS FINE ADVANCE PUBLICITY

The committee charged with arrangements for the fall meeting of the Texas Section, which also took place on October 28 and 29, did a particularly fine piece of advance publicity. The two-day session, which was held at Lubbock, was extensively featured in the local press. In addition, the Hotel Lubbock, headquarters of the meeting, issued a special letter of invitation to all members, as did the Lubbock Chamber of Commerce.

The opening session, held on Friday morning, was addressed by the Hon. Carl E. Slaton, mayor of Lubbock, who extended greetings to the group. He was followed by J. T. L. McNew, president of the Section, who responded on behalf of the Section. The first paper on the technical program was by W. D. Twitchell, of San Angelo, whose topic was "Surveying in Texas." The other main speakers were Marlin R. Smith, Jr., city engineer of Lubbock, and Carl F. Izzard, assistant highway engineer, U. S. Bureau of Public Roads. A number of discussions followed these presentations.

Speakers at the luncheon held that noon were R. F. Dawson and R. C. Gowdy, Vice-President of the Society. The afternoon session was held at Texas Technological College, with Harry N. Roberts, vice-president of the Section, in the chair. After a paper by Winfield Holbrook, vice-president and general manager of the Texas Land and Development Company, Capt. Hans Kramer, of the Corps of Engineers, U. S. Army, gave a talk on Conchas Dam and presented a three-reel motion picture. A question-and-answer period followed, after which the group was conducted about the grounds and buildings of the college. The ladies, in the meantime, were being entertained at a luncheon at the Hilton Hotel, followed by a bus tour of Lubbock and inspection of the college.

All gathered Friday evening for a dinner dance in the Lubbock Hotel. Society and Section officers present were introduced to the group, and special recognition was accorded three charter members of the Section—J. H. Brillhart, C. M. Davis, and John B. Hawley—who were present. Following dinner and these formalities, dancing was enjoyed until midnight.

Saturday morning was devoted to a business session. President McNew delivered his annual address, after which E. A. Baugh and Carl L. Svensen gave talks. The former is state director of operations for the WPA of Texas, while Mr. Svensen is chairman of the State Board of Registration for Professional Engineers. Numerous committee reports were read, including that of the nominating committee. The latter report led to the election of Lewis R. Ferguson, as president, and M. C. Nichols and John H. Bringhurst, as vice-presidents.

At noon the group adjourned to the campus of Texas Technological College for the barbecue that has become a famous feature of the Section's fall meetings. This feast, which was made possible through the courtesy of the West Texas Gas Company and the Texas–New Mexico Utilities Company, was thoroughly enjoyed by all, as is attested by the accompanying photographs.

TENNESSEE VALLEY SECTION HAS THREE-DAY SESSION

An interesting and diverse program was arranged for the annual meeting of the Tennessee Valley Section, which was held in Knoxville, Tenn., on November 10, 11, and 12. Registration took place at the Andrew Johnson Hotel, convention headquarters, on Thursday afternoon. The annual business meeting was also held at this time, the principal speaker at this session being L. F. Bellinger, Vice-President of the Society. That evening the mayor of Knoxville, Walter W. Mynatt, welcomed the group, and Henry L. Fruend, president of the Section, responded for the Section. Dr. Riggs was then introduced and gave a talk on the "Society's Program for Betterment." Mr. Fruend led the interesting discussion that followed.

The sessions on Friday were devoted to an open forum on the economic status of the engineer. The first speaker in this sym-

MEMBERS OF TEXAS SECTION ENJOY BARBECUED CHICKEN

L. R. Ferguson (Left), Newly Elected President of Section; Prof. P. M. Ferguson (Center); and J. H. Murdough, Chairman of Arrangements Committee

Leo J. Reynolds (Left) and Spencer J. Buchanan Chat with Dr. Riggs at Mid-South Banquet

posium was T. R. Agg, Director of the Society, who discussed the organization of engineers for economic reasons. He was followed by Willard S. Conlon, secretary of the National Society of Professional Engineers, and in the afternoon the speaker was Milton Fisher, national legislative representative of the Federation of Architects, Engineers, Chemists, and Technicians. There was an extensive general discussion of all three papers. C. W. Okey was chairman of the morning session, and A. S. Fry presided over the afternoon session. While this program was under way, the ladies were enjoying a drive through the Great Smoky Mountains National Park.

In the evening there was an informal banquet in the Andrew Johnson Hotel. The principal after-dinner speaker was Dr. Ruth Stevens, of the University of Tennessee, who discussed the timely subject, "European Affairs Today and What They Mean to the Future of Civilization." A general discussion followed.

Knoxville, situated in a region of great natural beauty and impressive engineering projects, is a fine starting point for field trips, and Saturday was given over to a number of interesting excursions. Members could choose between a motor trip through the Great Smoky Mountains National Park and visits to such places of engineering interest as the hydraulic developments of the Aluminum Company of America, and Hiwassee and Norris dams.

Index for 1938 in This Issue

At the end of this issue appears the index for the current volume of Civil Engineering, covering the issues from January through December 1938. As a matter of convenience it is included as a separate printed form, which can be removed intact by loosening the binding staples. It thus becomes available for filing or for binding in the yearly volume. With the latter idea in mind, the first page of the index has been designed to make a title page for the bound volume.

The index is as complete as it has been possible to make it in the space available. Every article and item has been included, a large percentage of them appearing under two or more headings, so that any desired article can be located quickly even though the searcher may recall only its general subject matter.

Separate reprints of the index may be had from Headquarters, 33 West 39th Street, New York, N.Y., at 15 cents a copy.

Appointments of Society Representatives

Frederick H. Mc Donald, M. Am. Soc. C.E., was appointed to represent the Society at the celebration of the fiftieth anniversary of the founding of the Georgia School of Technology, October 7–8, 1938.

C. E. Myers, M. Am. Soc. C.E., was appointed to represent the Society at the annual convention of the National Council of State Boards of Engineering Examiners, held at Des Moines, Iowa, October 17–19, 1938.

Jacob E. Warnock, Assoc. M. Am. Soc. C.E., has accepted an appointment to serve as an additional member of the Special Committee on Hydraulic Research.

William L. Darling Dies

William L. Darling, Hon. M. Am. Soc. C.E., died at his home in St. Paul, Minn., on October 27. He was 82. Although a native of the East and an engineer of New England training, Mr. Darling was fundamentally a product of the West, where he spent practically his entire professional lifetime. In fact, he had much to do with the development of that vast region.

Born at Oxford, Mass., on March 24, 1856, he was graduated from Worcester Polytechnic Institute in 1877, receiving the degree of B.S. in civil engineering. In 1927 he was awarded the honorary degree of doctor of engineering by the same institution. In 1879 he began his long career in railway engineering. For the next quarter of a century he was engaged in construction and maintenance work in connection with steam railways, particularly the Northern Pacific.

William L. Darling, 1856–1938

From 1901 to 1903 Mr. Darling was chief engineer of the Northern Pacific Railway, reporting to the president on construction and surveys and to the general manager on maintenance. For the next two years he served the Rock Island System in a similar capacity, and, during the same period, was vice-president of the Gulf Construction Company. From 1906 to 1916 he was chief engineer of the Northern Pacific Railway and allied lines, as well as vice-president and engineer of what is now the Spokane, Portland, and Seattle Railway. During this period of his connection with the Northern Pacific, several hundred miles of new double-track lines were built to eliminate grade and curvature; terminals were revised and enlarged; 750 miles of branch line were constructed; and numerous viaducts, bridges, and tunnels were built.

His war record included membership on the Minnesota Board for Industrial Preparedness and associate membership on the U. S. Naval Consulting Board. In 1917 he was a member of the United States commission of railway experts sent to Russia, where reports were made on the 5,500 miles of Trans-Siberian line from Petrograd south to the Caspian and Black seas. Upon his return to the United States in January 1918, he was active in national and state war work.

From 1921 on he served in various important organizations including the Board of Economics and Engineering of the National Association of the Owners of Railway Securities. At one time he was chairman of a committee of engineers representing various societies of the Twin Cities, appointed to recommend the best procedure for disposing of sewage in the metropolitan area. He also acted as chairman of an engineering committee for determining the physical value of the St. Paul City Railway. His civic duties included membership on the St. Paul City Planning Board and the St. Paul Zoning Board. He was also consultant to the building committees of various hospitals and schools, his diverse activities bearing adequate testimony to his versatility and integrity.

With all these interests he never forgot his first love—railroading, especially the economic problems of railroad location, construction, and operation. In particular, he was active in analysis and discussion of the numerous plans that have been advanced for the improvement of the general railway situation.

Mr. Darling was long active in Society affairs. In 1892 he was elected a Member, serving as Director from 1917 to 1919. He was made an Honorary Member in 1934. He was also a member of the American Railway Engineering Association and an honorary member of the Northwest Chapter of the Associated General Contractors of America and of the Association of Engineers of Leningrad (Russia).

Activities of the Soil Mechanics and Foundations Division

From the Report Presented at the Rochester Meeting on October 13, 1938

By CARLTON S. PROCTER, M. AM. SOC. C.E.
CHAIRMAN OF THE EXECUTIVE COMMITTEE OF THE DIVISION

IN ITS SHORT life of two years, the Soil Mechanics and Foundations Division has organized nine committees which are operating with a thoroughly wholesome enthusiasm and which are benefiting from the best thought of the outstanding engineers in this field. These committees are all listed in the 1938 Year Book of the Society, and detailed mention of their activities was made in CIVIL ENGINEERING for May 1938 (page 358). More recent information on a number of them is contained in the following paragraphs.

DIVISION COMMITTEES ARE ACTIVE

Under the chairmanship of H. A. Mohr, the Committee on Bearing Value of Pile Foundations has actively collaborated on the joint committee, under the Waterways Division, of which Admiral R. E. Bakenhus is chairman. The first report of this joint committee is nearing completion and is to be expected in the near future.

The Committee on Earth Dams and Embankments, under the chairmanship of L. F. Harza, has undertaken a most ambitious program of research activities, and much is to be expected from it. To date its principal activities have consisted of research into the compaction of earth fills in an effort to bring to light all the schemes which have been proposed and used, or which can be suggested for indicating the settlement of earth fills during and after construction, and also for indicating the internal water pressure in such structures for the purpose of constructing flow nets. It is hoped that in the near future a report will be issued and circulated to all builders of earth dams with the request that they install recording devices in their structures for the purpose of accumulating information for future use with reference to flow nets and settlements.

The paper on "Lateral Earth and Concrete Pressures," by Lazarus White and George Paaswell, which was published in the September PROCEEDINGS, is an indication of the activity and progress of the Committee on Foundations. Under the chairmanship of Mr. White, it has been carrying on research into the settlement of foundations, collecting records of settlement, and analyzing them to determine causes, with the objective of making the results available in the form of reports. In this connection it is cooperating with Prof. G. P. Tschebotareff in compiling data on building settlements in Egypt. Further, the Philadelphia Section has organized a committee headed by Professor Tschebotareff which will observe and report upon settlements of structures in the Philadelphia district.

Studies have been made on the bearing value of clay and various fine-grained materials in connection with the underpinning of important structures; also the effect of the flow of water on the bearing value of sands and silts. This committee has aided Prof. D. P. Krynine in the installation of apparatus for a soils mechanics laboratory at Yale and aided Professor Tschebotareff in the establishment of a soils mechanics laboratory at Princeton.

Under the chairmanship of Joel D. Justin, the Committee on Sampling and Testing has been extremely active from the time of its organization. Dr. Juul Hvorslev is under full-time employment in the direction of this research program. The work of this committee has been in the development of better methods and equipment for obtaining undisturbed samples, and the large amount of research carried on has been made possible only by the generous support of the Engineering Foundation.

MANY AGENCIES COOPERATE

It was realized at the outset that the success of this research project would depend to a large extent on the cooperation of a number of agencies. We are indebted to the Graduate School of Engineering at Harvard, to the Corps of Engineers of the U. S. Army, to the soil mechanics laboratories of the Corps of Engineers at Vicksburg, Pittsburgh, Kansas City, and Binghamton, and to several contracting corporations and engineering firms, for the splendid cooperation and assistance they have provided. Dr. Hvorslev makes his headquarters at the Harvard Graduate School of Engineering, where he enjoys the continued assistance and cooperation of Dr. Arthur Casagrande. He also makes many trips to construction jobs and soils laboratories in order to coordinate the work which other engineers and organizations are contributing to this program. The first concrete results of this work will be a report on the present status of the art of obtaining undisturbed samples of soil, which is scheduled for the Chattanooga Meeting in April.

Correspondence has been carried on with 16 European soil mechanics laboratories and organizations requesting information on current sampling methods and tools, and methods are being developed to determine the extent and degree of the disturbance suffered by the samples. Equipment has been designed and built by means of which longitudinal slices of small test specimens are accurately and rapidly cut out of the larger samples. The slices are partly dried in order to increase the color difference between the various soil layers. Thereafter the slices are photographed on process film and the distortion of the layers thereby determined. To determine the degree of disturbance, a portable spring loading device has been designed, built, and calibrated, through which changes in the elastic properties and strength of soils due to remolding may be determined by means of unconfined compression tests or squeeze tests.

Through the cooperation of the U. S. Corps of Engineers, extended field observations and field tests are in progress. Investigations are being made not only on the various types of sampling apparatus but also on the influence of the method used for forcing the sampling tube into the ground. The samples thus obtained are compared with samples obtained in open test pits.

Under the chairmanship of Prof. Glennon Gilboy, the Committee on Seepage and Erosion is carrying on research into the phenomenon of seepage through soils. Prof. Lorenz G. Straub, at the University of Minnesota, is conducting model investigations of seepage phenomena in earth dams. The committee is also undertaking a program of research on drainage filters for earth dams and dikes, through experiments carried on at the Massachusetts Institute of Technology.

The work of the Committee on Soil Mechanics Bibliography and of the Committee on Glossary of Terms and Definitions and Soil Classification is steadily progressing.

New Enrollment List for Technical Divisions to Be Prepared

ON December 1 a brief questionnaire will be sent to each member of the Society, giving him an opportunity to indicate again the Technical Divisions in whose work he is most interested. New enrollment lists for the Divisions will be prepared from the replies received, and on January 1, 1939, the old lists will be discarded.

Members are asked to name first the Divisions that engage their "primary" interest—that is, Divisions in which they would be available for active work. In most cases "primary" interest will be confined to one or two Divisions, and in no case can more than three be selected. In addition they may indicate Divisions in which they have a "general" interest—among other uses, this information will be helpful in planning Division activities, programs for meetings, and publications.

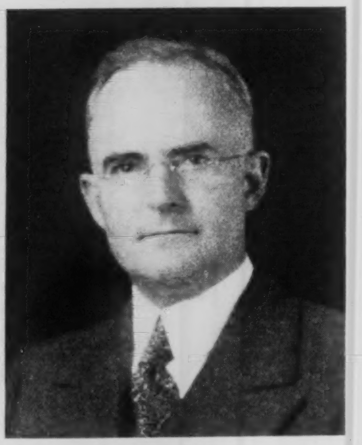
Attention should be called to the newcomer in the list of Technical Divisions—the Hydraulics Division. Authorized by the Board of Direction at its Jacksonvillem eeting, its object is "to promote the science and art of the civil engineer in matters dealing with water." To it have been assigned the research committees on meteorological data, flood protection data, hydraulic research, national water policy, and floodc ontrol. There is contemplated also a transfer of certain committees from the Irrigation Division to the Hydraulics Division, as well as the appointment of contact members from the latter to a number of existing committees of other Divisions dealing with special aspects of hydraulics. A more detailed account of its scope and proposed activities will appear in a forthcoming issue.

Members are urged to return their questionnaires on Division preferences without delay, in order that the data may be made available to the various executive committees for use in planning their activities for the coming year.

E.C.P.D. Takes Stock and Looks Ahead—A Review of Its Sixth Annual Meeting, October 1938

From an Account Prepared by the Staff of "Mechanical Engineering" for Simultaneous Publication in That Journal and Elsewhere

As THE Engineers' Council for Professional Development enters its sixth year it finds its prestige securely established by a record of specific achievements, and faces a program of continuing effort applied to problems that involve most of its original objectives.



J. P. H. PERRY, M. AM. SOC. C.E.
Newly Elected Chairman
of E.C.P.D.

An organization constructively critical of engineering education, of professional training and recognition, and of the individual from the time he prepares to select engineering as a course of study to the time he is competent to be recognized by law and by engineering societies as having attained professional status, E.C.P.D has applied to itself its techniques of analysis and forward-looking program formulation in a manner which demonstrates its sincerity of purpose and its virility.

Its apparent weakness, which arises from the fact that it is a small group of volunteer enthusiasts who meet infrequently, whose work is relatively little known and understood, whose function is almost entirely exploratory, and whose relationship with other organizations is principally advisory, may, paradoxically, be the source of its strength. Limited but representative membership avoids some of the confusion that results from popular participation in any program affecting an entire profession; infrequent gatherings make necessary the reiteration of purposes and procedures and provide the time essential for the maturing of well-considered action; while comparative freedom from administrative friction, and the absence of power to enforce its recommendations, eliminate suspicion that the E.C.P.D. seeks to usurp the authority of other bodies.

Of the validity of the foregoing statements, the 1938 annual meeting of the E.C.P.D. in New York, on October 21 and 22, gave ample evidence. In his contribution to the sixth annual report, Charles F. Scott, retiring chairman of E.C.P.D., announced as his keynote "E.C.P.D. as a continuing permanent agency." He reviewed what he termed the "pioneering period" and defined E.C.P.D. as being "both exploratory and promotional." "It proposes measures," he explained, "and on approval administers them primarily through the cooperative support of the constituent organizations." He then briefly reviewed and appraised the results attained through the activities of the four major committees. The most conspicuous achievement, he pointed out, had been the accrediting of engineering curricula in the schools.

In referring to professional recognition as a goal, Professor Scott said that "this difficult and involved problem is not to be settled quickly." As to results in general, some had been conspicuous, like accrediting, while others like guidance were intangible—"not conspicuous and definite and exciting." The next step lay in a changing world where "engineering must change, and our projects open a vision showing ways in which engineering can be made continuously better." He closed his report with a résumé of the year's activities.

REVISION OF GUIDANCE BOOKLET

The report of the Committee on Student Selection and Guidance provoked much discussion. Dean Sackett outlined the problem with which the committee was concerned, which has to do with men who are dropped from engineering schools because of scholarship or who withdraw because they find themselves unfitted to continue their engineering studies. The number of such men is as high as 40 per cent of the total number of men entering engineering courses. The problem is being attacked on one point by providing information to counselors of youth, and to this end 18,000 copies of the engineering Foundation's booklet, "Engineering—a Career, a Culture," supplied to E.C.P.D. by the Foundation free of charge, have been distributed.

Considerable discussion arose as to the value of the booklet. It appeared to be the consensus of opinion that it was positively helpful to parents and adult counselors, but that it was not so effective as guidance material for boys of high-school age who were contemplating a course in an engineering school.

Considerable discussion revolved about the objectives and value of guidance. Dean Sackett vigorously defended the underlying purpose of his committee's work. Boys, he said, were easily misled in choosing an educational program, and not only did the boys suffer as a result, but society suffered as well. It was his opinion that young men should not be led to aspire to goals they could not attain, as such a procedure led to defeatism, and a tragedy might be involved.

Taking a less serious view of the tragedy that might result from a boy's not continuing into an engineering career, A. R. Stevenson, Jr., of the General Electric Company, suggested that the drift from an engineering career might be a success in the individual case, and not a failure. An engineering training, he contended, was better than the old-fashioned academic training. It was to be remembered that mind training was the important thing, and this an engineering education provided.

Coming specifically to the question of the revised edition of "Engineering—a Career, a Culture," the Council authorized the Committee on Student Selection and Guidance to spend a sum not to exceed $200 for revising and editing a text to be submitted to the Council for approval.

BROAD PROGRAM IN PROFESSIONAL TRAINING PROPOSED

For the Committee on Professional Training, Chairman Eshbach announced that the report of the committee proposed a study of local society activities and interests in cooperation with the several societies, with the purpose of clarifying future policies or steps to be taken. In a review of the activities of the year 1937–1938, he noted the distribution of 2,000 copies of "Suggestions to Juniors" and the "General Reading List"; approximately 1,000 copies of the "Selected Bibliography of Engineering Subjects"; and about the same number of "University Extension Facilities."

Following a résumé of important elements and opportunities in professional development, the report recommended that, before the committee "undertakes any further major activities, a joint study be made through the educational committees and section chairmen of the several societies. This investigation should ascertain: (1) the nature of present activities, (2) the facilities available for them, (3) the manner in which they are sponsored and promoted, and (4) the response to them. The report should attempt to crystallize opinion as to: (1) further policy, (2) fields of activity of the several educational committees, (3) means of coordination with local educational institutions, and if necessary between societies, and (4) more effective ways of increasing membership." The Council voted to endorse this recommendation.

STUDY OF PROFESSIONAL RECOGNITION PROCEDURE

A progress report of the Committee on Professional Recognition was presented by J. W. Barker, M. Am. Soc. C.E. Dean Barker explained that the committee was concerned with uniformity in engineers' registration laws and not with the philosophy of registration, and that he was reporting on what had been accomplished in the revision of the Model Law for the information of the Council.

A report on methods of professional recognition in use in such professions as accounting, architecture, law, and medicine was submitted in summary form and without comment.

RESULTS OF ACCREDITING PROGRAM

Impressive statistics on the scope of the work involved in the task of accrediting curricula in engineering schools were presented by Chairman Compton of the Committee on Engineering Schools. Dr. Compton stated the general objective of the committee, "to formulate criteria for colleges of engineering which will insure to their graduates a sound educational background for practicing the engineering profession"; described the procedure of accrediting and the policy upon which the committee's work was based; and pointed out that the direct benefits incidental to the program included the advisory service which had been made available to institutions, a study which the committee was currently making of the admission of students with advanced standing upon transfer to accredited curricula from non-accredited curricula, and activity toward assuring a comprehensive survey of the status and trends of engineering education.

In commenting on the status of the accrediting program, the report stated that it had been successfully established at the beginning of the year 1937–1938. At the end of 1936–1937, as reported a year ago, 626 curricula at 129 institutions had been inspected and final action had been taken on 617 curricula. For the period covered by the present report, the committee was prepared to submit recommendations on 62 additional curricula involving 6 institutions that had submitted curricula for the first time. Twenty-two curricula previously accorded "term" accrediting, and 7 curricula initially voted non-accredited, were among those reinspected.

New Officers of E.C.P.D.

As announced at the Sixth Annual Meeting

Chairman: J. P. H. Perry, vice-president of Turner Construction Company, Former Director, Am. Soc. C.E.

Vice-Chairman: R. E. Doherty, president of Carnegie Institute of Technology.

Secretary: S. L. Tyler, secretary of the American Institute of Chemical Engineers.

Assistant Secretary (reelected): C. E. Davies, secretary of the American Society of Mechanical Engineers.

New Committee Chairman

Professional Recognition: C. F. Scott, professor of electrical engineering emeritus, Yale University; president of the National Council of State Boards of Engineering Examiners.

Committee Chairman Who Continue in Office

Student Selection and Guidance: R. L. Sackett, M. Am. Soc. C.E., recently dean of engineering of the Pennsylvania State College.

Electrical Engineering Training: O. W. Eshbach, special assistant, Personnel Department, American Telegraph and Telephone Company, N. Y.

Engineering Schools: Karl T. Compton, president of the Mississippi Institute of Technology.

Informal Dinner Talks Point Way to Future Programs

The evening session on October 21—a dinner meeting at the Engineers' Club—featured a series of brief informal discussions. Chairman Scott called first upon W. E. Wickenden, president of the Case School of Applied Science, who enumerated the goals attained by E.C.P.D. during its first five years and suggested a formulation of "patterns of competence" to guide engineering schools as a field for further effort. Personal competence, as an end sought in education, he said, could be broken down into fairly objective elements, as for example express attainment to be sought at graduation indicating competence in: graphical presentation; chemical laws, data, and technique; physical laws, data, and technique; mathematical analysis and computation; written and spoken English; social understanding; interpreting financial data; solving problems of engineering economy; and meeting ethical and personal problems.

E.C.P.D. could help make it clear, he concluded, that colleges could not produce for quickly shifting demands. With a four-year production cycle and a limited selection of material, colleges could not easily "retool" their plants and revamp their personnel. It therefore resulted that the best service the colleges could render would be to equip men for long-sustained personal and professional development after graduation. Enlightened industries and engineers recognized this fact, he asserted, but the problem remained of gaining a wider acceptance of it.

A long-range program of graduate research fellowships in engineering, comparable to the Rockefeller program of national research fellowships in science, was urged by the next speaker, Dr. Compton. He had talked, he said, with two men who had interests in large estates, and he was hopeful that the problem of financing might be solved. Such a program should be under the jurisdiction of a group of distinguished engineers, perhaps the Committee on Engineering Schools of E.C.P.D.

Later in the program R. E. Doherty, newly elected vice-president of E.C.P.D., suggested that that body undertake the framing of a philosophy of engineering education. "Nowhere," he said, "is there an authoritative statement of professional faith and purpose which might give intelligent direction to the now confused but earnest efforts of those who would help oncoming engineering generations get ready for their responsibilities." If such a philosophy could be framed, he continued, "educational administrators and faculties that are now hounded on the one side by demands for greater technical specialization and on the other for less, could then emerge from a justifiable timidity and deal with the situation with courage and confidence, because they would have the backing of E.C.P.D. on principle. There must not be authoritative curricula; institutions must be free to plan their programs. But in doing so they must have guiding principles that bear the endorsement of the profession as a whole."

Plots Course for E.C.P.D. Thinking

Another speaker was H. S. Rogers, M. Am. Soc. C.E., president of the Polytechnic Institute of Brooklyn. In his opinion, the primary purpose of E.C.P.D. is directed toward the development of the engineer in his cultural breadth and his level of understanding and competency. The program of accrediting engineering schools has been and should be motivated not by the purpose of controlling the schools but by the purpose of certifying to the minimum essentials available to the individual who seeks an engineering training. E.C.P.D., he said, should think not in terms of prescribing curricula but in terms of stimulating and aiding engineering education; it should think not in terms of controlling the profession by licensure but in terms of the development and recognition of that competency necessary to protect the public welfare and worthy to receive recognition by membership in the engineering societies.

As guest of honor, Frank B. Jewett, president of the Bell Laboratories, spoke extemporaneously. He expressed the hope that E.C.P.D. would continue as a permanent body. For, looking into the future with its vast mass of new knowledge and its changing social conditions, he saw the necessity of keeping the mélange of engineering relationships under the scrutiny of a body of men so eminent in their own right that their findings would be persuasive. He emphasized, nevertheless, that E.C.P.D. should resist all temptations and attempts to acquire power to enforce its findings.

John Fritz Medal to Frank Baldwin Jewett

Frank Baldwin Jewett, past-president of the American Institute of Electrical Engineers, has been chosen to receive the 1939 John Fritz Gold Medal, highest of American engineering honors. It is expected that the formal presentation will be made at the annual convention of the A.I.E.E. in January.

The award is made annually for notable scientific or industrial achievement by a board composed of representatives of the four Founder Societies. It was established in 1902 by friends of the late John Fritz, Hon. M. Am. Soc. C.E., to perpetuate the memory of his achievements in industrial progress.

ANNUAL MEETING of the Society, to be held in New York, N. Y., January 18-21, 1939

In and About the Society

AMONG the interesting and helpful activities of Local Sections may be noted the series of three lectures on soil mechanics which is being sponsored by the Philadelphia Section at the Drexel Institute of Technology. Two of the series were presented in November, and the third is scheduled for December 6. Blackboard demonstrations and explanations accompany these lectures, which are being given by L. A. Palmer, of the U. S. Bureau of Public Roads. Many engineers find the lectures of value, as do students in the engineering colleges in and around Philadelphia.

* * * *

ANOTHER pin-that-came-back story—this time with a police angle: On October 21 the pawnshop detail in a western city picked up a man having in his possession a Society badge. The name engraved on the back was not in the current Year Book. Correspondence with Society Headquarters developed the information that its owner had died in 1921. By October 26 the police had located the widow and returned the badge. A burglar had taken it from her home, with other jewelry, and it was not until it was returned that she knew she had been robbed.

News of Local Sections

Scheduled Meetings

BUFFALO SECTION—Luncheon meeting at the Buffalo Athletic Club on December 13, at 12:15 p.m.

CENTRAL OHIO SECTION—Dinner meeting in Pomerene Hall on the campus of Ohio State University on December 8, at 6:00 p.m.

CLEVELAND SECTION—Dinner meeting in Guild Hall on December 7, at 6:30 p.m. President Riggs and Vice-President Gowdy to be present.

COLORADO SECTION—Dinner meeting on December 5, at 6:30 p.m.

DAYTON SECTION—Annual Meeting at the Dayton Engineers Club on December 19, at 12:15 p.m.

GEORGIA SECTION—Luncheon meeting at the Atlanta Athletic Club on December 12, at 12:30 p.m.

INDIANA SECTION—Dinner meeting at the Washington Hotel in Indianapolis on December 2, at 6:00 p.m. (Meeting at 7:30 p.m.)

KANSAS CITY SECTION—Dinner meeting at the University Club on December 15, at 6:30 p.m.

KANSAS STATE SECTION—Dinner meeting at the Kansan Hotel in Topeka on December 9, at 6:30 p.m.

LOS ANGELES SECTION—Dinner meeting at the University Club (Los Angeles) on December 14, at 6:15 p.m.

METROPOLITAN SECTION—Technical meeting in the Engineering Societies Building in New York City on December 21, at 8:00 p.m.

MIAMI SECTION—Dinner meeting at the Seven Seas Restaurant on December 1, at 7:00 p.m.

NASHVILLE SECTION—Dinner meeting in Kissam Hall at Vanderbilt University on December 6, at 6:30 p.m.

NORTH CAROLINA SECTION—Meeting in Charlotte on December 10, at 2:30 p.m. (Dinner at 7:00 p.m.)

PHILADELPHIA SECTION—Dinner meeting at the Engineers Club on December 21, at 6:00 p.m. (Meeting at 7:30 p.m.)

PROVIDENCE SECTION—Lecture on New York World's Fair in the Providence Engineering Societies Building on December 14, at 8:00 p.m.

SACRAMENTO SECTION—Regular luncheon meetings at the Elks Club every Tuesday at 12:10 p.m.

SAN FRANCISCO SECTION—Dinner meeting at the Engineers Club on December 20, at 5:30 p.m.

TENNESSEE VALLEY SECTION—Dinner meeting of the Chattanooga Sub-Section at the Y.W.C.A. on December 20, at 6:30 p.m.; dinner meeting of the Asheville Sub-Section at the George Vanderbilt Hotel on December 12, at 6:30 p.m.

WISCONSIN SECTION—Dinner meeting at the City Club, Milwaukee on December 14, at 6:30 p.m.

Recent Activities

CENTRAL OHIO SECTION

A luncheon meeting, held at the Chittenden Hotel in Columbus on October 20, initiated the 1938–1939 activities of the Central Ohio Section. Following a business session, those present heard Thomas J. Donnelly, secretary of the Ohio Federation of Labor, speak on the subject, "Objectives of Organized Labor." Because of its timeliness this talk aroused a great deal of interest. There were 21 present.

CLEVELAND SECTION

The principal speaker at the November 1st meeting of the Cleveland Section was Frank R. Hanrahan, president of the Cleveland Railway Company. Because of the present controversy between the company and the City of Cleveland, Mr. Hanrahan's subject, "The Cleveland Railway Franchise," was especially interesting to citizens of Cleveland. Prof. G. Brooks Earnest also spoke at this session, giving a report on the Rochester Meeting of the Society.

IOWA SECTION

Members of the Iowa Section enjoyed two meetings in October. A dinner meeting, held in Ames on the 19th, attracted an attendance of 75. On the following day there was a luncheon meeting in Iowa City, with 40 present. On both of these occasions George T. Seabury, Secretary of the Society, was the principal speaker.

ITHACA SECTION

Members of the Ithaca Section gathered for their first meeting of the season in Willard Straight Hall on the campus of Cornell University on October 20. Following dinner and a brief business session, an entirely non-technical travelogue was given by Harry J. Van Valkenburg, police commissioner of Ithaca. This illustrated skit, entitled "From Cortland to Binghamton with Canoe and Paddle, Rod, Gun, and Camera, and a Couple of Pounds of Bacon," proved very entertaining. Accompanying Mr. Van Valkenburg as guests of the Section were Louis P. Smith, ex-mayor of Ithaca, who acted as guide, and H. P. Fenner, official photographer for the expedition.

KANSAS STATE SECTION

A number of business matters were discussed at the dinner meeting of the Kansas State Section, which was held at the Kansan Hotel in Topeka on October 14. The technical program consisted of a talk by Clare Van Orman, assistant engineer of flood control for the Kansas City District of the U. S. Engineer Office. Mr. Van Orman's subject was "Flood Protection for Topeka." There were 33 present.

LEHIGH VALLEY SECTION

The fall meeting of the Lehigh Valley Section took place at Lehigh University in Bethlehem, Pa., on October 10. The speaker heard at this session was C. S. Robinson, of Ithaca, N.Y., who discussed the subject of aerial mapping, using a number of illustrations. Since Mr. Robinson arrived by airplane, a number of the members had an opportunity to see the modern plane and equipment used in aerial mapping. The total of 70 present included 30 students.

LOS ANGELES SECTION

The October meeting of the Los Angeles Section was held at the University Club on the 12th. There were 138 present at the dinner preceding the meeting, while a few additional members arrived for the technical program. During dinner A. I. Stewart, director of the Department of Professional and Vocational Standards of the State of California, spoke briefly on the work of his department. After dinner Arthur McHenry, assistant secretary of the California Code Commission, described the work of codifying the civil engineers' registration law and the licensed surveyors' law. Then Maj. O. J. Todd gave an interesting address on "Flood Control and Irrigation Methods in China." Major Todd, who has been engaged in civil engineering work in China since 1919, illustrated his talk with numerous lantern slides of photographs taken there.

The Junior Forum of the Section met preceding the regular meeting. The speaker heard by this group was Ralph S. McLean, formerly with the U. S. Coast and Geodetic Survey, who gave a review of recent progress in seismic research.

Louisiana Section

On October 21 the fall meeting of the Louisiana Section took place at Baton Rouge. The program was initiated by an inspection trip to the site of the new Mississippi River bridge, now under construction near Baton Rouge. This visit was made possible through the courtesy of N. E. Lant, bridge engineer for the Louisiana State Highway Commission. Following the trip, a buffet supper was enjoyed at the University Country Club. The next feature on the program was a brief business meeting, after which E. L. Erickson, assistant bridge engineer for the Louisiana State Highway Commission, read a paper on the design and construction of foundations for the new bridge. An enthusiastic discussion followed. The total attendance of 150 included the entire Student Chapter membership at Tulane University and Louisiana State University. The Section announces that its annual scholarship awards to outstanding civil engineering students will be continued, this year's awards going to Clem B. Binnings, of Tulane University, and Volney P. Landry, of Louisiana State University.

Metropolitan Section

The Metropolitan Section initiated the fall season with a technical meeting held in the Engineering Societies Building in New York on October 19. "Labor Relations in the Construction Industry" was the subject of the address given at this session. This was presented by Edward P. Palmer, member of the firm, Senior and Palmer, of New York City, and president of the Associated General Contractors of America. Major Palmer outlined the expansion of organized labor, particularly in the fields of highway and heavy construction, and discussed its effect upon industry. Considerable discussion from the floor followed. The technical meeting was followed by a social hour, at which refreshments were served. The attendance was 325.

The Junior Branch of the Metropolitan Section held meetings on October 26 and November 9. At the former session an illustrated lecture on "Sanitation Problems of the Municipal Engineer" was given by Walter D. Binger, Commissioner of Borough Works of the City of New York Those present on the 9th had the pleasure of hearing James K. Finch, Director of the Society and Renwick Professor of Civil Engineering at Columbia University, speak on "Engineering and the Graphic Arts."

Michigan Section

There were 30 present at the annual meeting of the Michigan Section, which took place at the Statler Hotel in Detroit on October 19. During the business session the ballots for officers for the coming year were canvassed, the results being as follows: Edward D. Rich, president; Leroy C. Smith, first vice-president; Edward L. Eriksen, second vice-president; and Lewis C. Wilcoxen, secretary-treasurer. The technical program consisted of a talk by Brown C. Tiney, chief engineer of the Calcium Chloride Association, on the "Development and Utility of Calcium Chloride in Highway Improvements."

Mid-Missouri Section

A dinner meeting of the Mid-Missouri Section took place in Columbia on September 23, with 27 present. After dinner the group adjourned to the engineering building at the University of Missouri, where 35 Student Chapter members joined the meeting. The principal speaker was Dean Chedsey, director of the Missouri School of Mines, who discussed some of the problems now facing engineers. G. H. Dyer, assistant superintendent of the Springfield City Water Company, then gave a résumé of four articles appearing in recent issues of Society publications. Another dinner meeting of the Section, held in Jefferson City on October 28, attracted an attendance of 37, this number including 15 members of the University of Missouri Student Chapter. Following a brief talk by Raymond W. Brooks, secretary of the Section, N. W. Remley, of the Missouri State Highway Department, read a paper prepared by L. W. Pickles, also of the highway department. The principal speaker of the evening was Ernest E. Howard, consulting engineer of Kansas City, who discussed the place of the engineer in the present-day social order.

Mohawk–Hudson Section

On October 28 members and guests of the Mohawk–Hudson Section met in Albany, N.Y., for a regular session. Preceding the meeting, which was attended by 25, there was a dinner in honor of Charles A. Harrell, the guest speaker. Mr. Harrell, who is city manager of Schenectady, N.Y., addressed the meeting on the subject of "City Management as a Form of Government." In his treatment of the subject Mr. Harrell pointed out the weaknesses of this form of government as well as its benefits. Considerable discussion followed. The other speakers were Charles S. Sterling, publicity director of the Section, who outlined a plan for promoting the publicity of the Section; G. Reed Shaw, Section representative to the Local Sections conference held at the Rochester Meeting, who gave a report on the conference; and Warren C. Taylor, president of the Section, who asked for an open discussion of the type of program desired by the membership. Professor Taylor's request met with an enthusiastic response.

New Mexico Section

The regular September meeting of the New Mexico Section was advanced to August 26 to take advantage of the presence of Merrill Bernard, chief of the River and Flood Division of the U. S. Weather Bureau, Washington, D.C. Mr. Bernard discussed the work of the division. The attendance numbered 14.

North Carolina Section

A technical meeting of the North Carolina Section took place at the King Cotton Hotel in Greensboro on November 2, with 36 members and guests present. The feature of the occasion was an illustrated lecture on "The Evolution of Railway Rail" given by J. B. Akers, assistant chief engineer of the Southern Railway System. In connection with his talk, Mr. Akers exhibited a display of the various types of rails from 1830 to the present. The next speaker was John A. Abbott, senior in civil engineering at Duke University and president of the North Carolina Students Conference, who reported on the proposed expansion of the conference into the Carolina Conference of Student Chapters. Then R. D. Douglas, member of the Greensboro Bar, discussed the question, "Why Should Civil Engineers Be Licensed?" The meeting concluded with a report on the Rochester Meeting, given by L. F. Bellinger, Vice-President of the Society. Frank T. Miller was in charge of the program committee.

Oklahoma Section

Twenty-four members and guests of the Oklahoma Section gathered for a dinner meeting on October 17. On this occasion the technical program consisted of a talk on the mechanics of aerial photography, which was presented by Fred C. Casler, president of the Aero Exploration Company. An enthusiastic discussion, led by M. C. Burke, followed.

Philadelphia Section

The Philadelphia Section's first meeting of the season, held at the Engineers Club on October 19, was devoted to a discussion of the engineering features of the New York World's Fair. After a few words of welcome by President Doherty and comments on the November meeting by Charles S. Shaughnessy, the session was turned over to Solomon M. Swaab, chairman for the evening. Mr. Swaab outlined a few of the unusual engineering features of the project and then presented the first speaker, Carlton S. Proctor, consulting engineer of New York City and Director of the Society. Illustrating his talk with pictures and diagrams, Mr. Proctor emphasized the dual objective of preparing for the fair and, at the same time, constructing a permanent park. Then L. B. Roberts, assistant chief engineer of the New York World's Fair Corporation, outlined the engineering organization set up to handle the work. Discussion of both papers concluded the technical program, and the members adjourned for the customary refreshments. There were about 100 present at the meeting, while the attendance at the dinner preceding it was 37.

Portland (Ore.) Section

There were 45 present at the November 2 meeting of the Portland (Ore.) Section. During the business session it was announced that the new Local Section constitution has been favorably voted upon and that, henceforth, the Section will be known as the Oregon Section. A symposium on regional planning had been arranged for the technical program. The first speaker was Roy F. Bessey, regional counselor in the Pacific Northwest for the National Resources Committee, who outlined the general features of regional planning and its objectives. Samuel B. Morris, dean of the engineering school at Stanford University and water consultant for the

National Resources Committee, followed with a survey of the water problems encountered in the Pacific Northwest. A general discussion, led by V. B. Stanbery, consultant to the Oregon State Planning Board, concluded the evening.

SACRAMENTO SECTION

Interesting and varied programs were arranged for the October luncheon meetings of the Sacramento Section. On the 4th the speaker was D. Jackson Faustman, assistant traffic engineer of Sacramento, who discussed the subject of the engineer and traffic problems. Leslie W. Stocker, senior civil engineer of the Public Utilities Commission of San Francisco, was the speaker on the 11th, his topic being the enlargement of O'Shaughnessy Dam. There was the large attendance of 118 at the October 18th meeting, the occasion being the Section's annual Ladies' Day. The speaker was Dr. Roscoe L. Clark, of Sacramento, who recounted the life of Caleb Greenwood, pioneer scout and explorer. October 25th was designated Navy Day, and the speaker was Robert E. Garrels, of the Construction Corps of the Mare Island Naval Station, who discussed the education of the navy's staff specialists. In addition to these gatherings, there was a special field trip, made on the 15th, to the debris dam being built by the U. S. Engineer Office on the North Fork of the American River for the storage of mining debris.

ST. LOUIS SECTION

Missouri's new ten-year road program, known as Amendment No. 6, was explained to the St. Louis Section at its regular monthly meeting held at the Hotel Mayfair on October 24. This discussion was given by Robert B. Brooks. In addition, A. P. Greensfelder, president of the Fruin-Colnon Contracting Company, described the beginnings of a plan to develop a scenic parkway along the Mississippi River from its source to its mouth. This plan has received the approval of Secretary Ickes. There were 34 present.

SAN DIEGO SECTION

The first meeting of the San Diego Section, after the summer recess, took place on September 22, with 18 present. An interesting talk on foundations was the feature of the occasion. This was given by Robert V. Labarre, consulting foundation engineer of Los Angeles. The October meeting, held on the 25th, was addressed by Samuel Morris, dean of the engineering school at Stanford University, who gave a talk on "Engineering Education and Ideals." His remarks were especially interesting to a group of engineering students from San Diego State College, who attended the meeting by special invitation of the Section. The total of 30 present included 14 students.

SAN FRANCISCO SECTION

The San Francisco Section reports a number of activities. On September 13 members of the Section attended a joint dinner meeting sponsored by the American Society for Testing Materials in honor of their secretary, C. L. Warwick. About 180 members and students went, on October 1, to visit the Mare Island Navy Yard to inspect the huge construction program now in progress. On October 6 a large group from the Section attended a public lecture given by Julian Hinds, assistant chief engineer of the Colorado River Aqueduct project, on the subject, "Bringing Water Across the Desert." The regular meeting of the Section, which was held on October 11, was devoted to a discussion on soil mechanics. Those participating in the symposium were Harmer E. Davis, H. J. Brunnier, C. H. Lee, and Hyde Forbes (the latter's paper was read by H. A. Williams). Over 200 members, students, and guests enjoyed this program, which was arranged by T. P. Dresser, Jr., chairman of the Soil Mechanics Committee.

SEATTLE SECTION

The Seattle Section held its October meeting at the Engineers Club on the 31st, with 54 for dinner and 24 additional members and guests arriving for the technical program. Following dinner and a short recess in the club rooms, Ray M. Murray gave a talk on the Mercer Island pontoon bridge across Lake Washington. He was assisted by R. H. Thomson and George H. Shearer. Mr. Murray, who had charge of preliminary work on the project, described the project and the tests that were made. Mr. Thomson, one of the four consultants on the project, gave a history of the highway route in question, while Mr. Shearer described the contracts to be awarded on the project. The latter is district engineer of the Washington State Highway Department.

SPOKANE SECTION

A special meeting of the Spokane Section took place at Coulee Dam, Wash., on October 15. During the afternoon members were taken on a tour of the dam project by engineers connected with the U. S. Bureau of Reclamation and Consolidated Builders, Inc. After dining together, the visitors then met for a technical session. The first speaker on the program was A. F. Darland, engineer with the Bureau of Reclamation, who reviewed construction progress on the dam and discussed the major difficulties encountered and their solution. The other speaker was Arthur Donaldson, who explained in detail the plans for diversion of the Columbia during the remainder of the construction period. Mr. Donaldson, is on the staff of Consolidated Builders, Inc. Fred J. Sharkey, assistant office engineer for the Bureau of Reclamation, was in charge of arrangements for the meeting and introduced the speakers. The total of 60 present included 29 student and faculty members from Washington State College and four from the University of Idaho faculty.

UTAH SECTION

Members of the Utah Section gathered on the afternoon of November 5 for a field trip to the flood control project near the Garfield smelter of the American Smelting and Refining Company. The group was met at the smelter by R. A. Marriott, plant engineer, who, with L. M. Winsor, conducted the party through the flood control works. Following the tour of inspection and dinner at the Salt Lake Yacht Club, Mr. Marriott showed some interesting motion pictures he had taken of the project. He then showed films he had made on a trip to the West Indies and Panama, and Prof. Thomas C. Adams concluded the meeting by presenting several reels of motion pictures he had made. There were 21 present.

Student Chapter Notes

UNIVERSITY OF SOUTH CAROLINA (WALTER E. ROWE)

On October 27 the University of South Carolina Student Chapter had the pleasure of being host to Lyle F. Bellinger, Vice-President of the Society, who discussed the rôle of the civil engineer in the building and upkeep of the U. S. Navy. His talk was illustrated by slides of docks and yards. The list of those present included 14 members of the Chapter and approximately 30 visitors.

VIRGINIA MILITARY INSTITUTE

On October 22 the Virginia Military Institute Student Chapter acted as host to the Virginia Section of the Society on the occasion of its fall meeting. The morning was devoted to registration and the presentation of a technical program. Following addresses of welcome by J. A. Anderson and C. E. Kilbourne, of the staff of Virginia Military Institute, W. T. Howe, president of the Virginia Section, thanked the Chapter for its hospitality. Three Student Chapter members—E. B. Livesay, of the University of Virginia; Martin C. Jones, of Virginia Polytechnic Institute; and L. M. Griffin, of Virginia Military Institute—spoke briefly. After this a technical program consisting of talks by the following was presented: F. W. Scheidenhelm, consulting hydraulic engineer of New York City; R. H. Smith, general manager of the Norfolk and Western Railway; and E. M. Hastings, chief engineer of the Richmond, Fredericksburg, and Potomac Railroad Company. R. B. H. Begg, professor of civil engineering at Virginia Polytechnic Institute, presided at this session.

Following luncheon, the members enjoyed a football game between Washington and Lee University and Virginia Polytechnic Institute.

WASHINGTON STATE COLLEGE

Twenty-five members of the Washington State College Student Chapter accompanied the Spokane Section of the Society on an inspection trip to Coulee Dam on October 15. O. G. F. Markhus conducted the members of the Chapter on a tour of inspection. A full account of the visit is given in the "News of Local Sections" department of this issue.

ITEMS OF INTEREST

Engineering Events in Brief

Civil Engineering for January

Steel facings for gravel and rock fill dams are discussed by R. T. Logeman in an article scheduled for the January issue of Civil Engineering. The writer traces the early history of steel dams in the United States, pointing out the excellent service record of the three built at about the turn of the century, and discussing the unfortunate foundation failure of the fourth dam that was made "an exhibit against the use of steel for dam construction and served to stop further steel dam installations for the ensuing 25 years." He then turns to the modern welded steel facing, and takes up in detail the principles of both design and construction that should ensure permanence and economy. Mr. Logeman's paper received an honorable mention award in the recent competition of the James F. Lincoln Arc Welding Foundation, and has been released for exclusive use in Civil Engineering.

Another timely paper in the January issue treats the topic of the relationship of the maximum probable flood to spillway capacity. As the authors, S. M. Bailey and G. R. Schneider, Associate Members of the Society, point out, a majority of the hundreds of dams currently being proposed will be of a type that cannot be overtopped without catastrophe; hence adequate spillway design is of paramount importance. The paper discusses the various factors that must be considered, gives a brief summary of the procedure for estimating the required spillway capacity, and, in addition, presents a group of isohyetal maps (for the United States east of the 104th meridian) showing the maximum probable storm precipitation to be expected at various locations for drainage areas of 50, 500, 1,500, and 5,000 square miles.

At least six additional articles, drawn from various fields of interest, will be included in the issue.

Annual Meeting of National Council of State Boards of Engineering Examiners

Delegates from 26 states and representatives of several national engineering societies attended the nineteenth annual convention of the National Council of State Boards of Engineering Examiners in Des Moines, Iowa, October 17 and 18. In his report, the secretary stated that during the past year Rhode Island and Kentucky adopted engineering registration laws, and are now members of the Council. The Council is composed of 40 member boards, 38 states, Hawaii, and Puerto Rico, representing a total of approximately 60,000 registered professional engineers and land surveyors.

The following resolution was adopted: "That it be the consensus of the members of the National Council of State Boards of Engineering Examiners that this Council is an advisory and coordinating agency established primarily to assist the State Boards of Registration for Professional Engineers in a more efficient and uniform administration of state registration laws, and that its functions and activities include the certification of engineers, jointly with state boards, for reciprocal registration in the various states, and the operation of a national clearing house and information bureau for matters pertaining to the legal registration of professional engineers, serving state boards, state committees, engineering societies, individual engineers, and the public."

The following officers were elected for the ensuing year: president, Dr. Charles F. Scott, of Yale University, New Haven, Conn.; vice-president, Col. A. C. Polk, M. Am. Soc. C.E., of Birmingham, Ala.; director from western zone, Prof. J. H. Dorroh, M. Am. Soc. C.E., of Albuquerque, N.Mex.; director from southern zone, Fred E. Rightor, M. Am. Soc. C.E., of Austin, Tex. The following officers hold over: past-president, Prof. S. H. Graf, Corvallis, Ore.; director from central zone, Prof. J. O. Kammerman, Rapid City, S.Dak.; director from northeastern zone, Col. C. E. Myers, M. Am. Soc. C.E., Philadelphia, Pa. T. Keith Legaré, M. Am. Soc. C.E., of Columbia, S.C., was reelected executive secretary for his sixteenth term.

Special appointments were made, as follows: As a representative of the Council on the Engineers' Council for Professional Development, Prof. N. W. Dougherty, M. Am. Soc. C.E., of Knoxville, Tenn.; representing the Committee on Examinations on the Committee of National Bureau of Engineering Registration, Lewis M. Martin; and representing the northeastern zone on the same committee, Prof. W. W. Hodge, of Morgantown, W.Va.

The next annual meeting of the Council will be held in San Francisco in July 1939.

Pont d'Avignon on Page of Special Interest

On the frontispiece or Page of Special Interest of this issue is pictured the Pont d'Avignon, on the River Rhône, in France. This view was submitted by E. D. Kingman, Assoc. M. Am. Soc. C.E., who wrote:

"During the past summer (1938) I revisited Avignon, Vaucluse, in the Midi, and as has been my happy custom several times in the past, I made a little pilgrimage to the old Eglise Saint Didier, Avignon, where are enshrined the holy relics of Bénézet, shepherd lad who, according to legend, in 1178 appeared in Avignon and there claimed that he had received from God a command to bridge the Rhône.

"I took the enclosed view in July; it shows three remaining arches projecting into the Rhône from the Avignon shore. One other approach arch on the left crosses the Boulevard du Rhône and abuts on the Rocher des Doms. The chapel, now abandoned, is badly defaced, but the masonry throughout the bridge is in fair condition considering the little attention given to it during the past few centuries.

"While this bridge is familiar to many engineers, very few studies and fewer recent photographs have been published."

Shortly after the beginning of the thirteenth century, or some fifty years after its completion, according to Mr. Kingman, the Pont d'Avignon, then known as the Pont Bénézet, had attained outstanding prominence among the great structural accomplishments of the age. The construction of the bridge was a daring undertaking; as built it had 19 or 20 circular arches (authorities differ as to the number) and a length of nearly half a mile. The masonry was dry-laid, of cut and rough-dressed stone for the most part, though some of the arch stones show considerable care as to dimensions and alinement. The material was local Jurassic rock which abounds in the ridges of the Midi.

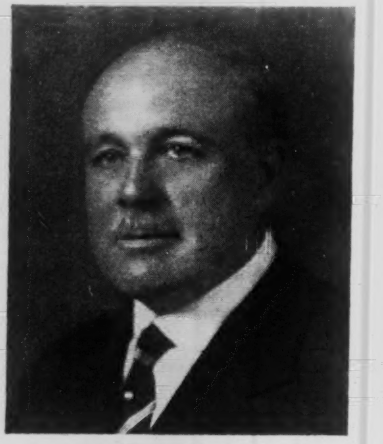
The building of this bridge, which required 11 years (1178–1189), was a pious work, that is, one sanctioned by the Church and administered by it. It was the predecessor of other bridges erected at later dates which were similarly pious works instituted and maintained by organizations which may be traced to Bénézet, who bore the title *Divus Inceptor et Minister Pontis*, based on his having received divine inspiration in conceiving and building such projects.

There is reasonable proof that the Frères du Pont may have participated in constructing and maintaining the Pont Saint Espirt and the Pont de la Guillotière at Lyon, both Rhône crossings, and also the old London Bridge. Certainly these bridges, and many others which followed later, conformed in design and in administration to the Pont d'Avignon, for in addition to similar technical features each had its chapel dedicated to Saint Nicholas.

Bénézet died shortly before his task was completed. He was embalmed and interred in a stone coffin within the chapel of Saint Nicholas erected on the Pont d'Avignon from which he was later transferred to another resting place. During the last century his relics were placed in an illuminated repository of a chapel reserved for their veneration in the old Eglise Saint Didier, Avignon. On the fourteenth of every September "lectures" are read and litanies recited for the marvellous works that he created and for the miraculous deeds that he performed. Here indeed is an unusual distinction for a builder of bridges.

Chicago Engineers Club Honors Edward Haupt

HONORARY membership in the Chicago Engineers Club was conferred on Edward Haupt, M. Am. Soc. C.E., on October 25, 1938. In the 32 years of the club's existence only 16 other men have been thus honored, and the list includes such notables as Chanute, Sooysmith, and Goethals—among those now deceased—and Herbert Hoover, Ralph Modjeski, John W. Alvord, and Theodore L. Condron.



EDWARD HAUPT

Mr. Haupt has been with the Strobel Steel Construction Company since 1905—since 1924 as its president. Among the more important projects under his direction have been the erection of steel work for the Madison Street terminal of the Chicago and Northwestern Railway, the Kansas City Union Station, the dirigible hangar at Belleville, Ill., and bridges in many parts of the United States. He was president of the Chicago Engineers Club in 1914 and 1915.

Frank F. Fowle, in presenting the award, referred to the "Haupt dynasty of engineers." Four consecutive generations of the family have provided six men prominent in the profession—General Herman Haupt, born in 1817; Jacob and Lewis, his sons; Charles Herman and Edward, sons of Jacob; and, in the fourth generation, Caspar Wistar, son of Edward, who has been a member of his father's organization for 19 years. Lewis M. Haupt was for many years a member of the Society.

A Road Map of Hydraulic Engineering

"THE Road Map of Hydraulic Engineering in Iowa," just published as Bulletin 15 of the University of Iowa Studies in Engineering, should find welcome acceptance with the technically minded traveler through that state. With only a few minutes study he can locate all hydraulic structures and projects along his route, and plan an inspection trip to suit his fancy.

On the 21 by 14-in. map, cities and roads appear in black; rivers and lakes in blue; and watershed boundaries and points of hydraulic interest in red. About 100 such points are shown. Their location is indicated by a red circle whose size indicates the magnitude of the project, and appropriate letters indicate their nature—as water power, flood control works, channel improvement observation point, and so forth. There is also a key number, referring to a brief description of the project in the bulletin in which the map is inserted. Map and text are by E. W. Lane, M. Am. Soc. C.E., of the Iowa Institute of Hydraulic Research, and Edward Soucek, Jun. Am. Soc. C.E., formerly of the same Institute.

In the hope that eventually similar maps for all the states may be produced, the institute has collected data on the location of several thousand points of hydraulic interest throughout the country. Data for any particular area will be supplied to any organization that will cooperate in this program by issuing a map of its own locality.

L. M. Lawson Chosen as U. S. Arbiter in Land Dispute with Mexico

LAWRENCE M. LAWSON, M. Am. Soc. C.E., has been named by Secretary of State Cordell Hull as the representative of the United States on the two-man international commission that is to fix the value of the agricultural lands involved in the prolonged expropriation controversy with Mexico. The total of the claims involved is about $10,000,000.

Appointment was announced on November 12, when a general agreement for solution of the controversy was reached between Secretary Hull and the Mexican Minister of Foreign Relations, Eduardo Hay. The Mexican member of the commission, significantly, is also an engineer—Gustavo P. Serrano.

The two commissioners will begin their work on December 1 in Mexico, D.F., and are to complete their valuations by May 31, 1939. If they are unable to agree on any particular, a third commissioner will be immediately appointed from the permanent commission set up in Washington under the terms of the Gondra treaty. Both countries agree to abide by the findings.

Mr. Lawson has had a prominent part for many years in international enterprises of an engineering nature. Since 1927 he has been U. S. Commissioner of the International Boundary Commission (on the Mexican boundary) whose authority in 1933 was extended to include extensive rectification work on the Rio Grande. He also for 11 years worked on the development of the Pan-American Highway.

Senor Serrano is also connected with the International Boundary Commission, being water commissioner for the Mexican Section.

It is gratifying to note that the outstanding success of the work of the International Boundary Commission has thus been recognized in the appointment of two of its engineers to this new and difficult assignment.

Semi-Centennial of American Mathematical Society

As the delegate of the American Society of Civil Engineers, Leon S. Moisseiff attended the semicentennial celebration of the founding of the American Mathematical Society, held at Columbia University on September 6–9.

"Organized at Columbia University in 1888," writes Mr. Moisseiff, "this mathematical society soon became national in scope. As evidenced by the topics of the 66 papers presented at this meeting, it embraces the entire field of pure mathematics.

"The opening session was attended by delegates of American national societies interested in mathematics and its applications, as well as by delegates of Canadian and European societies. The audience was addressed by Nicholas Murray Butler, president of Columbia University. As ever, President Butler displayed his wide understanding. Extolling the value of mathematics in human reasoning he pleaded for bringing a broader understanding of its conceptions and methods to the general public.

"The broadest and most interesting paper from the point of view of mathematics was delivered by Dean Birkhoff of Harvard University on 'Fifty Years of American Mathematics.' Dean Birkhoff covered the progress of the entire field of pure mathematics in the United States during the last half century. Always interesting in his presentation, he traced the path of the growth of mathematics, illuminating it in the light of his comprehensive knowledge. But towards the end, when the subject of applied mathematics was approached and your delegate eagerly awaited new light in the somber path of reality, the lecturer remarked that no applied mathematics could really be the subject of pure mathematics. He then spoke of ergotics as applied mathematics. Your dejected engineering listener then felt that his was of the flesh and not of the spirit.

"The variety of the subjects treated in the papers and the attendance of so many distinguished mathematicians made the meeting a really remarkable date in American mathematics."

NEWS OF ENGINEERS

Personal Items About Society Members

A. H. ABEL, assistant port manager and assistant chief engineer of the Port of Oakland, Calif., was recently elected president of the Pacific Coast Association of Port Authorities for 1939.

Harold E. Hedger, since 1934 assistant chief engineer of the Los Angeles County Flood Control District and for the past fifteen years an employee of the District, has been appointed chief engineer to fill the vacancy caused by the resignation of C. H. Howell.

George J. Schroepfer has been appointed chief engineer and superintendent of the new Minneapolis-St. Paul Sanitary District sewage disposal system after ten years as assistant engineer on the design and construction of the system.

R. L. Prichard has resigned as resident engineer for the J. B. McCrary Company, Inc., of Atlanta, Ga., in order to accept a position as office manager for C. H. Cook, Inc., contractors of Buena Vista, Ga.

F. L. Schaffel, who is with the American Bridge Company, is now assistant engineer in the field on the construction of the Bronx-Whitestone Bridge, with headquarters in New York City. He was formerly in the Pittsburgh (Pa.) office of the company.

Samuel Richard Young has left the Tennessee Coal and Iron Railroad Company to accept an engineering position with Robert and Company, Inc., of Atlanta, Ga.

Douglas A. Nettleton, previously a designer with the Port of New York Authority, has accepted a position as assistant engineer for the Pennsylvania Turnpike Commission, with headquarters in Harrisburg, Pa.

Adolph George Sunda has resigned as assistant engineering aide with the Tennessee Valley Authority to accept a position as instructor in the department of civil engineering at the University of Tennessee.

Robert M. Lingo, formerly water works engineer for Boonville, Mo., has become connected with A. W. Hefling, consulting engineer of Hutchinson, Kans. His headquarters are Wilson, Kans., where he is resident engineer on the construction of a sewer system for the town.

Charles R. Gallagher is now a junior traffic safety engineer in the traffic safety department of the California State Division of Highways, with headquarters in Sacramento, Calif. He was formerly in the bridge department of the Division of Highways.

R. B. Ward has been reinstated in the U. S. Bureau of Reclamation for assignment as field engineer on the construction of Green Mountain Dam of the Colorado-Big Thompson Project. Previously he was employed by the Metropolitan Water District of Southern California as resident engineer on the construction of Cajalco Dam, dike, and appurtenant works.

E. H. Elwin, Jr., who is in the U. S. Bureau of Biological Survey, was recently transferred from Havre, Mont., to the office of the regional director in Portland, Ore., where he is assistant civil engineer in charge of the Survey's WPA operations in Region 1, consisting of the states of Washington, Oregon, California, and Nevada.

Charles E. Durr, Jr., recently resigned as construction engineer and assistant to the consulting engineer for the New York's World's Fair Commission to become associated with the Board of Standards and Appeals of the New York State Department of Labor. He is located at 11 North Pearl Street, Albany, N.Y.

James W. Greely is now employed as an instructor in civil engineering at Rice Institute.

Thomas B. Casey has accepted a position as assistant chief engineer in the State of Illinois Division of Waterways, with headquarters at Springfield, Ill.

Fred Lavis, consulting engineer of New York City, has been appointed consultant to the government of Venezuela and is now in that country making a general examination, from both an engineering and economic point of view, of its land transportation problems. Under the three-year plan recently adopted in that country, an extensive program of highway and railway development is under consideration.

Li Shu-t'ien is at present engaged in amalgamating four Chinese engineering colleges into one under the name of National Northwestern Engineering College. This institution is located at Ku Lu Pa, Cheng Ku Hsien, Shensi Province.

Winston E. Black, formerly a member of the civil engineering staff at Lehigh University, has taken a position as instructor in the department of theoretical and applied mechanics at the University of Illinois.

Gustavo L. Govin is now chief engineer of locations in Venezuela for Interamerica, Inc., engineers and contractors of New York City. His headquarters are at Caracas, Venezuela.

James H. Le Van, who is with the U. S. Public Health Service, has been relieved from duty as officer in charge of the Scioto River Investigation at Chillicothe, Ohio, and assigned as officer in charge of the Aedes Aegypti Control Unit, with headquarters at the Quarantine Station, Miami Beach, Fla.

Charles M. Noble recently joined the engineeering staff of the Pennsylvania Turnpike Commission, which is engaged in the construction of a toll express highway between Harrisburg and Pittsburgh. His headquarters are at Harrisburg, Pa. For the past thirteen years Mr. Noble has been on the engineering staff of the Port of New York Authority.

Clarence J. Velz, formerly acting chief engineer for the PWA at Newark, N.J., has been appointed head of the civil engineering department and professor of sanitary engineering at Manhattan College.

Robert C. McDowell has accepted a position with the R. C. Mahon Company, of Cleveland, Ohio, on the construction of the Main Avenue Bridge. He is chief engineer for the structural contractors on this project.

W. K. Hatt, after forty-five years of service in the civil engineering department at Purdue University, will retire from active duty on January 1, 1939, with the title of emeritus professor of civil engineering. Following a trip to Australia, Professor Hatt will maintain his residence at Purdue.

George G. Thomas, engineer of metal structures for the Atlantic Coast Line Railroad, recently received an honorary diploma from the North Carolina Society of Engineers for "his work, completed in May 1938, in strengthening for further service of thirty-eight steel bridges on the Atlantic Coast Line Railroad (principally in North Carolina) . . . ." Mr. Thomas, who has been with the Atlantic Coast Line for over thirty years, gave a brief description of the work for which he was honored in the May 1938 issue of Civil Engineering.

John Stearns, until recently division engineer for the Metropolitan Water District of Southern California on the construction of the Colorado River Aqueduct, has accepted a position as senior engineer on the power-flood control surveys of the Federal Power Commission. His headquarters are in Washington, D.C.

John S. Hale has resigned his position with the U. S. Geological Survey at Vicksburg, Miss., to become connected with the Harwood Beebe Company of Spartanburg, S.C.

Francis B. Wilby, colonel, Corps of Engineers, U. S. Army, has taken over his duties as division engineer of the North Atlantic Division, succeeding Brig. Gen. Edmund L. Daley. His headquarters are in New York City. Colonel Wilby was formerly division engineer of the Gulf of Mexico Division.

Walter H. Starkweather, formerly technical assistant engineer to the chief civil engineer, U.S. Coast Guard, Washington, D.C., has been made division civil engineer, for the Seattle Division of the Coast Guard, with headquarters in the National Building, Seattle. The territory in this Division includes Oregon, Washington, and Alaska.

John H. Gaynor has opened an office at 233 Broadway, New York City, for the general practice of law in conjunction with his engineering work. He will continue to follow his present activities in advice and selection of engineering personnel.

Charles S. Boardman has been appointed consulting engineer in the specialty sales division of the Carnegie-Illinois Steel Corporation, with headquarters in Pittsburgh, Pa. Until recently Mr. Boardman was with the Jones and Laughlin Steel Corporation.

Joseph F. Kunesh, previously assistant chief engineer for the Board of Water Supply, City of Honolulu, is now director of the Territorial Planning Board, with headquarters in Honolulu, Hawaii.

DECEASED

Edward Lorenzo Abbott (M. '06) retired civil engineer of Berkeley, Calif., died on September 30, 1938, at the age of 79. Mr. Abbott's early career included eight years with Sooysmith and Company, engineers and contractors of New York City, and several years as engineer in charge of tests for the Pennsylvania Railroad Company. He was employed on bridge work for the Missouri Pacific Railway and on building construction in New York City and Washington, D.C. He went to Berkeley a number of years ago.

Laurence Adams Ball (M. '14) consulting engineer of New York City, died there on October 16, 1938, at the age of 56. Mr. Ball's early experience included six years as structural engineer for Reed and Stem, architects. He entered private practice in 1911, and in 1918 formed the partnership of Ball and Snyder. Mr. Ball was associated with other engineers on the construction of the Delaware River Bridge between Philadelphia and Camden. He also designed a section of the Interborough Rapid Transit subway and, most recently, the stadium for the New York World's Fair.

William La Fayette Darling (M. '92) of St. Paul, Minn., died in that city on October 27, 1938, at the age of 82. Mr. Darling served as Director of the Society from 1917 to 1919 and was elected an Honorary Member in 1934. A sketch of his career appears in the "Society Affairs" department of this issue.

Frederick Webster Deck (Assoc. M. '28) on the staff of the Philadelphia Electric Company, Philadelphia, Pa., died on September 26, 1938, at the age of 42. During the war Mr. Deck served as a first lieutenant in the U. S. Army in France and, later, was with the army in Germany. From 1920 to 1923, when he was retired for disability, he was in this country as captain, Corps of Engineers, U. S. Army. In 1925 Mr. Deck joined the staff of the Philadelphia Electric Company, where he was structural engineer for the mechanical division at the time of his death.

Frederick Edward Ferris (Assoc. M. '98) formerly assistant division engineer for the Transit Commission of New York City, died on April 18, 1938. Much of Mr. Ferris' career was spent in transportation work in New York City. He was assistant engineer for the Rapid Transit Railroad Commission and, for a number of years, assistant division engineer for the Public Service Commission. In 1928 he retired from the New York City Transit Commission.

Dale Janverin Graham (Assoc. M. '19) who was with the Northern Engineering and Development Company, Ltd., of Winnipeg, Canada, died in October 1938. He was 50. Mr. Graham spent the first ten years of his career in railroad work—with the Atchison, Topeka and Santa Fe Railway, the Pennsylvania Railroad Company, and the New York State Railways. Later he was advisory engineer for the Graton and Knight Manufacturing Company, of Worcester, Mass., and for a number of years was manager of railway utility for the Winnipeg Electric Company.

Thomas Heatley (M. '30) retired civil engineer of New York City, died at his home in Lakewood, N.J., on October 28, 1938. Mr. Heatley, who was 73, was a native of England. Four years ago he retired after forty years of active employment in New York City municipal engineering. He was with the Bureau of Buildings, Manhattan and Bronx, from 1895 to 1929—first as special inspector and, later, as assistant engineer.

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

Louis C. Hill (M. '05) Past-President of the Society, died at his home in Los Angeles, Calif., on November 5, 1938, at the age of 73. Mr. Hill served as Vice-President of the Society in 1928 and 1929 and as President in 1937. His biography is given in the "Society Affairs" section.

David Leavitt Hough (M. '97) of New York City, died at Amityville, L.I., on October 12, 1938, at the age of 73. As head of the United Engineering and Contracting Company and the New York Tunnel Company, he constructed one of the first tunnels under the East River and was a contractor for the Interborough Rapid Transit Company on subway construction and on two crosstown tunnels for the Pennsylvania Railroad. He saw service in the Spanish-American War and in the World War, holding a colonel's commission in the latter. For several years preceding the war he was engaged on various railroad projects in Russia, and following the war he was for a number of years negotiating engineer for the Foundation Company, of New York City.

William Howland Leffingwell (M. '93) consulting engineer of Los Angeles, Calif., died on August 24, 1938, at the age of 82. A native of San Francisco, he was believed to be the oldest graduate of the University of California. For many years Mr. Leffingwell was chief engineer of the Mono Power Company (the first power plant in the Owens River valley) and of the Colorado Midland Railroad. For the last twenty years of his life he maintained a consulting practice.

Joseph Elbert Moody (Assoc. M. '08) president of the Illinois Asphalt Company, of Chicago, Ill., died in that city on October 23, 1938. For several years Mr. Moody was chief engineer of the Massey Concrete Products Corporation, of Chicago. Later he maintained a consulting practice in Chicago, and from 1930 to 1936 he was consulting engineer for the Department of Public Works of that city. In the latter year he became president of the Illinois Asphalt Company.

George Pillsbury Morrill (M. '11) since 1932 Connecticut distributor for the American Bitumuls Company, died at Bridgeport, Conn., on September 29, 1938, at the age of 63. Mr. Morrill was in the Philippine Civil Service from 1901 to 1907, and from the latter year until 1914 he was employed on the design and construction of water and flood-protection works for the Cuban government. From 1916 to 1932 he was with the Raymond Concrete Pile Company—first as superintendent of construction and, later, as district manager.

John Edwin Ostrander (M. '05) professor emeritus of mathematics and civil engineering at Massachusetts State College, died at Amherst, Mass., on October 19, 1938, at the age of 73. From 1888 to 1891 Professor Ostrander was a member of the New York State Engineering Department, after which he taught at Lehigh University and the University of Idaho. He became head of the mathematics department of Massachusetts State College in 1897, remaining in that capacity until his retirement from active teaching in 1935. Professor Ostrander was also known as an astronomer and meteorologist.

Ren Brown Perrine (M. '10) vice-president and secretary of the George S. Rider Company, of Cleveland, Ohio, died on September 27, 1938, at the age of 65. From 1902 to 1910 Mr. Perrine was chief engineer of the structural department of the Van Dorn Iron Works Company, of Cleveland. Later he maintained a consulting practice (Prack and Perrine) in Pittsburgh, and for the past twenty years he was with the George S. Rider Company, architects and engineers.

Henry Witbeck Potter (M. '88) of New York City, died on October 9, 1938, at the age of 79. Mr. Potter's experience included eight years with Read and Campbell and a number of years as assistant engineer in the export office of the Westinghouse Electric and Manufacturing Company at Coahuila, Mexico. From 1908 until his retirement in 1931 he was assistant manager of the Tlahualilo Agricultural Company at Tlahualilo, Mexico.

Joseph Warren Silliman (Assoc. M. '14) of Philadelphia, Pa., died in Ashtabula, Ohio, where he was visiting, on September 22, 1938, at the age of 73. For many years Mr. Silliman was in the Philadelphia municipal service—from 1908 to 1912 in the Department of Public Works, and from the latter year until his retirement in 1930 as assistant engineer in the Bureau of Highways. His early experience included traction work and five years with the Philadelphia Rapid Transit Company.

William Pliny Snow (M. '02) of Auburndale, Mass., died on October 12, 1938.

at the age of 83. From 1881 to 1890, Mr. Snow was in railroad and mill construction work. In 1890 he became connected with Lockwood, Greene and Company and Successors, where he remained for the rest of his life in full charge of the construction of many mills and other projects.

Edward Augustus Southworth (M. '12) retired consulting engineer of Mill Valley, Calif., died in 1938, at the age of 60. Mr. Southworth was in Hawaii for many years—as civil engineer for the Honolulu Plantation Company, civil engineer for the Hawaii Department of Public Works, and county engineer of Hawaii. Upon his return to this country, he was city engineer of Pacific Grove, Calif., and, at the same time, maintained a consulting practice in Monterey, Calif. Later he was consulting engineer and general manager of the Seattle (Wash.) Mausoleum Company.

John Thad Whitney (Assoc. M. '20) assistant engineer in the U. S. Engineer Office at Pittsburgh Pa., died on September 29, 1938, at the age of 47. In 1915 he became connected with the Koppers Company of Pittsburgh, Pa., and remained there in varying capacities until 1927. From the latter year until 1930 he was designing engineer in the Bureau of Bridges and Structures of the City of Pittsburgh, and from 1930 to 1931 assistant engineer for the Pittsburgh City Transit Commission. In 1933 Mr. Whitney joined the Corps of Engineers, U. S. Army.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From October 10 to November 9, 1938, Inclusive

Additions to Membership

Adams, Philip Ernest (M. '38), Designing Engr., The Canadian Bridge Co., Ltd., Walkerville, Ont., Canada.

Allen, Arthur Egbert (Jun. '38), Box 75, Sewickley, Pa.

Alter, Amos Joseph (Jun. '38), R. F. D. 2, Rensselaer, Ind.

Bagley, Charles Thomas (Jun. '38), 2d Lieut., 1st Engrs., Fort Du Pont, Del.

Barbarossa, Nicholas Leonard (Jun. '38), Officers' Club, Fort Du Pont, Del.

Barnes, George Wallace, Jr. (Jun. '38), 1005 South College Ave., Bryan, Tex.

Beall, James Faulkner, Jr. (Assoc. M. '38), Associate Engr., U. S. Engr. Office, Box 410, Poplar Bluff, Mo.

Beck, Edward Adam (Jun. '38), Town Mgr., Tappahannock, Va.

Beeson, James Farr (Jun. '38), 1800 Fourth Ave., Tuscaloosa, Ala.

Bergman, Mark Leslie (Jun. '38), 8849 One Hundred and Eighty-Sixth St., Hollis, N.Y.

Berry, Myron Secrist (Jun. '38), Observer, U. S. Bureau of Public Roads, Iowa Eng. Experiment Station, Iowa State Coll., 2718 Lincolnway, Ames, Iowa.

Bishop, Edgar Wayne (Jun. '38), 814 Summit St., Linden, N.J.

Black, Joseph Kenneth (Assoc. M. '38), Asst. Constr. Engr., TVA (Res., 915 Vine St.), Chattanooga, Tenn.

Brater, Ernest Fredrich (Jun. '38), Instr., Civ. Eng., Univ. of Michigan, Ann Arbor, Mich.

Bravo, Arthur Charles (Jun. '38), Route 4, Box 37, Petaluma, Calif.

Brink, Lester LeRoy, Jr. (Jun. '38), 804 South 1st St., Champaign, Ill.

Bulkley, Robert Aldrich (Jun. '38), Care, U. S. Bureau of Reclamation, Pinedale, Wyo.

Bullington, Ernst Albert (Jun. '38), Anderson Hotel, Crowley, La.

Burnecke, Ralph Claude (Assoc. M. '38), Junior Engr., WPA (Res., 527 West 8th St.), Dallas, Tex.

Byrd, Henry Downs (Jun. '38), Care, C. Y. Thomason Const. Co., Meadows of Dan, Va.

Carroll, Roger Merle (Jun. '38), 710 Valley St., Maplewood, N.J.

Chaffee, Donald Lester (Jun. '38), 91 South Main St., Mansfield, Pa.

Chase, Alfred LeRoy (Jun. '38), 1219 Garber Ave., Lincoln, Nebr.

Cladny, Harold (Jun. '38), 4707 Kansas Ave., N.W., Washington, D.C.

Coggeshall, Jonathan Wright (Jun. '38), Bedford Rd., Pleasantville, N.Y.

Courtright, Frederick Vail (Jun. '38), R. D. 1, Centerburg, Ohio.

DeGeer, Myron Winterstein (Jun. '38), Asst. Engr., State Board of Agriculture, Div. of Water Resources, 1019 Topeka, Topeka, Kans.

DeMoyer, Robert (Assoc. M. '38), Associate Prof., Civ. Eng., Pennsylvania Military Coll. (Res., 822 East 14th St.), Chester, Pa.

Dershimer, John Edward (Jun. '38), Box 401, Alvin, Tex.

Diamond, Joseph Bertram (Assoc. M. '38), Counsellor at Law, 152 West 42d St., New York, N.Y.

Donaldson, Paul Blair (Jun. '38), Box 865, Rapid City, S.Dak.

Drucker, Daniel Charles (Jun. '38), 2084 Grand Ave., New York, N.Y.

Durnin, Albert Ward (Jun. '38), Y. M. C. A., Ithaca, N.Y.

Eberhart, Alanson Clyde (Assoc. M. '38), Engr., Aero Motors Corporation, New York, N.Y. (Res., Woodsedge, Canoe Hill Rd., New Canaan, Conn.)

Epstein, Edwin Heineman (Jun. '38), 1510 M St., Sacramento, Calif.

Farley, William Russell (Assoc. M. '38), Engr. (Expert), Federal Power Comm., 988 Merchandise Mart (Res., 1413 East 60th St.), Chicago, Ill.

Ferguson, Harley Bascom (M. '38), Pres., Mississippi River Comm., and Div. Engr., Lower Mississippi Val. Div. (Res., Vicksburg Hotel), Vicksburg, Miss.

Fischer, Ernest William (Jun. '38), Engr. and Draftsman, Baltimore County Met. Dist., Court House, Towson (Res., 3147 Lyndale Ave., Baltimore), Md.

Floyd, Robert (Jun. '38), Draftsman, Am. Bridge Co., 703 Park Pl., Elmira, N.Y.

Flynn, William Schilling (Jun. '38), Sales Representative, Eddy Valve Co., Waterford (Res., 83 Third St., Troy), N.Y.

Fuertes Ramirez, Florencio (Assoc. M. '38), Engr., Fuertes y Chavez Orozco (Res., Condesa St. 1026), Mexico, D.F., Mexico.

TOTAL MEMBERSHIP AS OF NOVEMBER 9, 1938

Members	5,666
Associate Members	6,216
Corporate Members	11,882
Honorary Members	28
Juniors	3,651
Affiliates	76
Fellows	1
Total	15,638

Garrison, Carman William (Jun. '38), 10 Eckert Ave., Newark, N.J.

Girard, Peter Fred, Jr. (M. '38), Acting Engr. of Sewer Design, San. Dist. of Chicago (Res. 8541 Drexel Ave.), Chicago, Ill.

Goodman, Walton Perkins (Assoc. M. '38), Res. Engr., State Highway Dept., Jacksboro, Tex.

Gowdey, Dwight Maynard (Jun. '38), Box 1911, Yale Station, New Haven, Conn.

Graves, Charles Leonidas, Jr. (Jun. '38), Care, Struck Constr. Co., Fort Knox, Ky.

Guard, Charles Lewis, Jr. (Jun. '38), Care, Dept. of Civ. Eng., Ohio State Univ., Columbus, Ohio.

Ham, Alton Sinclair (Jun. '38), Care, A. M. Tasker, College Ave., Orono, Me.

Hanson, Odin Sigvard (Jun. '38), 204 Fenton Ave., Grand Forks, N. Dak.

Harding, James Fenton (Jun. '38), Junior Naval Archt., Philadelphia Navy Yard, 3752 North 15th, Philadelphia, Pa.

Hartman, George Frederick (Jun. '38), 5502 Sixteenth Ave., N.E., Seattle, Wash.

Hensley, Laurence Sherman (Jun. '38), Box 224, Milton, W. Va.

Hetherton, Percival (Assoc. M. '38), Consultant, National Resources Committee, State Planning Council, 400 Old Capitol Bldg., Olympia, Wash.

Hill, Henry Forrest (Jun. '38), 166 Elwood Ave., Newark, N.J.

Howland, James Chase (Jun. '38), Mass. Inst. Tech., Graduate House 512-A, Cambridge, Mass.

Hutchins, Xavier Sutton (Jun. '38), 1527 Hepburn Ave., Louisville, Ky.

Iversen, Lloyd (Jun. '38), 2519 Ridge Rd., Berkeley, Calif.

Jared, John Ballard, Jr. (Jun. '38), Instrumentman, Am. Petroleum Co. (Res., 2021 Isabella), Houston, Tex.

Jeppesen, Gordon Lutz (Jun. '38), 404 Eng. Hall, Univ. of Illinois, Urbana, Ill.

Johnson, Lloyd Ruebin (Assoc. M. '38), Res. Engr., FSA, Dept. of Agriculture, 1506 Hayden St., Amarillo, Tex.

Kayser, John Edward (Jun. '38), Box 414, Copper Cliff, Ont., Canada.

Kelly, John Joseph (Assoc. M. '38), Asst. Engr., Board of Transportation, City of New York (Res., 3224 Grand Concourse), New York, N.Y.

Kincaid, Russell Grady (Assoc. M. '38), 6136 Charlotte St., Kansas City, Mo.

Krivo, Albert A. (Jun. '38), 117 Cooper St., Peoria, Ill.

Kullas, Albert John, Jr. (Jun. '38), New York Univ., Coll. of Eng. (Box 21), University Heights, New York, N.Y.

Lamont, Charles Malloy (Jun. '38), Care, Bureau of Public Roads, Natchez Trace Parkway, Ridgeland, Miss.

Lange, Fred Carl (Assoc. M. '38), Designer, Eng. Dept., Bethlehem Steel Co., Fabricating Div. (Res., 8241 Rhodes Ave.), Chicago, Ill.

Larson, Bernt Oscar (Jun. '38), 1103 West Oregon St., Urbana, Ill.

Lavezzoli, Charles Lewis (Jun. '38), Box 46, Chester, Conn.

Leeuw, Henry Alexander (M. '38), Const. Engr., Allen N. Spooner & Son, Inc. (Res., 2550 Davidson Ave.), New York, N.Y.

Lewis, Norvin Joseph (Jun. '38), 160 South Willard St., San José, Calif.

Lindblom, Leonard Carl (Jun. '38), 3540 Broadway, Chicago, Ill.

McMahon, Thomas Earl (Jun. '38), Hermosa, S. Dak.

McNeil, Bruce William (Jun. '38), 619 North Arden Drive, Beverly Hills, Calif.

Mains, Robert Marvin (Jun. '38), Research Graduate Asst., Univ. of Illinois (Res., 807 West Nevada), Urbana, Ill.

Malevich, Vladimir (M. '38), Structural Designer, Jones & Laughlin Steel Corporation (Res., 344 Becks Rud Rd.), Pittsburgh, Pa.

Mann, David Morton (Jun. '38), Box 43, Alhambra, Mont.

Milliron, William Ralph (Jun. '38), 1891 Greenfield Ave., West Los Angeles, Calif.

Miron, Charles (Assoc. M. '38), Care, U. S. Engr. Office, Galveston, Tex.

Pahl, Rudolph Mentz (Jun. '38), 1084 Cragmont Ave., Berkeley, Calif.

Paterson, John Lamb (Assoc. M. '38), Archt. and Civ. Engr. (Palmer & Turner), 17 Canton Rd., Shanghai, China.

Pattabongse, Charoen (Jun. '38), Care, Siamese Legation, 2300 Kalorama Rd., Washington, D.C.

Peacock, Earl George (Jun. '38), Box 1135, Mason City, Wash.

Penman, Robert Roy (Jun. '38), 214 Talbot Laboratory, Univ. of Illinois, Urbana, Ill.

Pennell, Robert Stewart (Jun. '38), 321 Forest Drive, Kokomo, Ind.

Person, Kenneth William (Jun. '38), 535 Newton Ave., North, Minneapolis, Minn.

Pine, Edward Leonard (Jun. '38), 205 University Terrace, Reno, Nev.

Potter, James Oscar (Jun. '38), 830 North 4th St., Quincy, Ill.

Reglin, Frederick, Jr. (Jun. '38), 613 East Marvin Ave., Waxahachie, Tex.

Ricker, Edmund Rouhan (Jun. '38), Groton, Vt.

Rising, Robert Reynolds (Jun. '38), 424 Benton Boulevard, Kansas City, Mo.

Robertson, James Mueller (Jun. '38), 806 Florida Ave., Urbana, Ill.

Roosa, Paul Robert (Jun. '38), 2010 South Broadway, Boulder, Colo.

Rose, Grover Donald (Jun. '38), 94 Dover St., La Grange, Ill.

Rosebraugh, Vernon Hart (Jun. '38), Aloha, Ore.

Runyan, Damon Ogden (Jun. '38), Draftsman, Harrington & Cortelyou, Kansas City, Mo.

Ruth, Leo William, Jr. (Jun. '38), 371 Spencer Ave., San José, Calif.

Salgo, Michael Nicholas (Jun. '38), 1732 North Shore Ave., Chicago, Ill.

Saville, William Gladstone Smith (Assoc. M. '38), Asst. Engr., Bridge Design Section, TVA (Res., 305 Peachbloom Drive), Chattanooga, Tenn.

Scarborough, Ralph Lambert (Jun. '38), Hartville, Mo.

Schellhase, Harold Edward (Jun. '38), 1216 Edgar St., Evansville, Ind.

Schiff, Louis (Jun. '38), 1044 Findlay Ave., New York, N.Y.

Shelton, Willie Clyde (Jun. '38), 1114 Arlington Ave., Lawton, Okla.

Smith, William Fielding (Assoc. M. '38), Constr. Engr., Wharton County, Box 1216, Wharton (Res., 4503 Montrose Boulevard, Houston), Tex.

Snow, Martin Joseph (Jun. '38), 968 Medio Rd., Santa Barbara, Calif.

Steele, Harry Williams (Assoc. M. '38), Town Engr.; (Steele Bros.), 13 North Boulevard, West Springfield, Mass.

Steinau, Alfred Bertin (Jun. '38), 109 Elk Ave., New Rochelle, N.Y.

Taylor, Harold Ivor, Jr. (Jun. '38), R.R. 6, Box 570, Kansas City, Mo.

Taylor, William Richard (Jun. '38), 4251 North East Hazelfern Pl., Portland, Ore.

Thoma, Edward Charles (Jun. '38), Civ. Eng. Bldg., Purdue Univ., West Lafayette, Ind.

Thomas, Lloyd Leslie (Jun. '38), $616^{1}/_{2}$ North Occidental Boulevard, Los Angeles, Calif.

Thomson, Herbert Serrell, Jr. (Assoc. M. '38), Deputy Director, Div. of Employment, WPA, 47 Walters Ave., West New Brighton, N.Y.

Throop, Joseph Franklin (Jun. '38), Instr., Civ. Eng. Dept., Rensselaer Polytechnic Inst., 1580 Tibbits Ave., Troy, N.Y.

Touritzin, Alexander Michail (Jun. '38), 1304 West Clark, Urbana, Ill.

Tuttle, James Mason (Jun. '38), Care, Highway and Railway Div., TVA, Chattanooga, Tenn.

Vieto, Claude (Jun. '38), Box 50, Station H, New York, N.Y.

Voodhigula, Oui Thieng (Jun. '38), 1403 West Park St., Urbana, Ill.

Wagoner, Walter Price (Jun. '38), Box 795, Salisbury, N.C.

Waling, Joseph Lee (Jun. '38), 210 Varsity Apartment, West Lafayette, Ind.

Weber, John Leroy (M. '38), Hydr. Engr., Div. of Research, SCS (Res., 5921 Thirty-third St., N.W.), Washington, D.C.

Webster, Marvin James (Assoc. M. '37), Asst. Engr., U. S. Engr. Office, Nashville, Tenn. (Res., 220 Koser Ave., Iowa City, Iowa.)

Wefring, Peter Meyer (Assoc. M. '38), Designer, Braithwaite Burn & Jessop Constr. Co., Ltd., Box 264, Calcutta, India.

West, George William (Jun. '38), Box 1523, Alice, Tex.

Wight, Harry James (M. '38), Engr., Knoxville Housing Authority (Res., 800 North 3d Ave.), Knoxville, Tenn.

Wilken, Robert Henry (Jun. '38), Care, U. S. Engr. Dept., Auburn, Calif.

Willoughby, Graham Paul (Assoc. M. '38), Project Engr., State Highway Dept., Box 505, Florence, Ala.

Witkege, Francis Leo (Jun. '38), 14 Lancaster St., Worcester, Mass.

Woffenden, Richard (Assoc. M. '38), Res. Engr., West Sussex County Council, 385 Upper Shoreham Rd., Shoreham by Sea, Sussex, England.

Wolf, Herbert Charles (Jun. '38), Junior Engr., Russell & Axon (Res., 6101 Alabama), St. Louis, Mo.

Wood, William Howell (Assoc. M. '38), Engr. of Materials and Tests, State Highway Dept. (Res., 1504 Hardouin Ave.), Austin, Tex.

Wright, John Urquhart (Jun. '38), With Standard Oil Co., Gen. Eng. Dept. (Res., 1301 Leavenworth St.), San Francisco, Calif.

Wysong, John Bond (Assoc. M. '38), Associate Engr., FSA (Res., 7611 Georgia Ave.), Washington, D.C.

Membership Transfers

Allen, C. Frank (M. '78; Hon. M. '38), Prof. Emeritus, Mass. Inst. of Tech., 88 Montview St., West Roxbury, Mass.

Alvord, Henry Bissell (Assoc. M. '27; M. '38), Prof., Civ. Eng. and Head, Dept. of Civ. Eng., Northeastern Univ., 316 Huntington Ave., Boston, Mass.

Aultman, William Whitescarver (Jun. '31; Assoc. M. '38), Asst. Engr., Met. Water Dist. of Southern California, 306 West 3d St., Los Angeles, Calif.

Chettle, Earl Vincent (Jun. '34; Assoc. M. '38), Asst. Engr., U. S. Bureau of Reclamation, New Customhouse, Denver, Colo.

Colburn, Robert Talbot (Jun. '24; Assoc. M. '33; M. '38), Constr. Plant Engr., TVA (Res., 645 Orlando St.), Knoxville, Tenn.

du Plantier, Donald Cecil Allard (Assoc. M. '29; M. '38), Associate Prof., Structural Eng., Univ. of Alabama, Box 1721, University, Ala.

Gill, Oliver Preston (Jun. '29; Assoc. M. '38), Office Engr. and Computor, Petty Geophysical Eng. Co., Drawer 2061, San Antonio, Tex.

Johnson, Theodore Rangnor (Jun. '34; Assoc. M. '38), Shaft Engr., Board of Water Supply, New York City, Fishkill Div., 1262 Sterling Pl., Brooklyn, N.Y.

Kasel, Rudolph Gustav (Jun. '24; Assoc. M. '30; M. '38), Hydr. Engr. (Dist. Engr.), U. S. Geological Survey (Res., 512 Clark St.), Iowa City, Iowa.

Kinsel, Harry Lyman (Jun. '28; Assoc. M. '38), Asst. Engr., Greeley & Hansen (Res., $1650^{1}/_{2}$ West Juneway Terrace), Chicago, Ill.

McMurray, Donald Irvine (Jun. '28; Assoc. M. '38), Bridge Designer, State Bridge Dept., Highway Bldg. (Res., 623 Percival St.), Olympia, Wash.

Mann, Joseph (Jun. '32; Assoc. M. '38), Secy.-Treas. and Constr. Mgr., M & M Dredging & Constr. Co., 812 Postal Bldg., Miami, Fla.

Marston, Anson (Assoc. M. '93; M. '03; Hon. M. '38), Dean Emeritus of Eng., Iowa State Coll., Ames, Iowa.

Matter, Lawson Deacon (Assoc. M. '24; M. '38), Dist. Engr., Pennsylvania Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Nickle, Harry Gordon (Jun. '26; Assoc. M. '38), Asst. Irrig. Engr., Div. of Irrig., Bureau of Agri. Engr., U. S. Dept. of Agriculture, Care, Board of Water Engrs., Austin, Tex.

Noe, Thomas Pasteur, Jr. (Jun. '30; Assoc. M. '38), Engr., Carolina Steel & Iron Co. (Res. 407 South Chapman St.), Greensboro, N.C.

O'Neill, John Henry (Assoc. M. '29; M. '38), San. Engr., State Board of Health, Civ. Courts Bldg. (Res., 637 Lowerline St.), New Orleans, La.

Picket, David (Jun. '29; Assoc. M. '38), Pres., Gotham Constr. Corporation, 103 Park Ave. (Res., 845 West End Ave.), New York, N.Y.

Speert, Julius Louis (Jun. '27; Assoc. M. '38), Asst. Engr., Water Resources Branch, U. S. Geological Survey, North Interior Bldg. (Res., 5040 New Hampshire Ave., N.W., Apartment 103), Washington, D.C.

Stephenson, Leonidas Dacosta, Jr. (Jun. '28; Assoc. M. '38), Instr., Civ. Eng., Univ. of Maine, Orono (Res., 195 Middle St., Old Town), Me.

Thuring, Adolph Carl (Jun. '36; Assoc. M. '38), Asst. Engr., U. S. Engr. Dept. (Res., 523 Cheyenne St.), Fort Peck, Mont.

Tuttle, Arthur Smith (Jun. '87; Assoc. M. '94; M. '98; Hon. M. '38), Cons. Engr., 10 East 40th St., New York, N.Y.

Wall, Edward Everett (M. '05; Hon. M. '38), Director of Public Utilities, City of St. Louis, 311 City Hall (Res., 5361 Pershing Ave.), St. Louis, Mo.

Weymouth, Frank Elwin (Assoc. M. '01; M. '07; Hon. M. '38), Gen. Mgr. and Chf. Engr., The Met. Water Dist. of Southern California, 306 West 3d St., Los Angeles, Calif.

Woods, Kenneth Brady (Jun. '34; Assoc. M. '38), Asst. Engr., State Dept. of Highways, 180 West Norwich Ave., Columbus, Ohio.

Reinstatements

Fuellhart, Donald Egbert, Assoc. M., reinstated Oct. 17, 1938.

Sedelmeyer, Herman Anton, Assoc. M., reinstated Oct. 17, 1938.

McDonnell, Porter Wilson, Assoc. M., reinstated Oct. 21, 1938.

Schuster, Karl Rudolph, M., reinstated May 16, 1938.

Snyder, Howard Halsey, Assoc. M., reinstated Oct. 25, 1938.

Walton, Howard Lacy, Assoc. M., reinstated Nov. 9, 1938.

Resignations

Endlich, Philip Jacob, Assoc. M., resigned Oct. 24, 1938.

Guerdrum, George Hagbart, M., resigned Nov. 2, 1938.

Nash, Philip Curtis, M., resigned October 19, 1938.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment from Members to Board of Direction

December 1, 1938

Number 12

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years RCM*
Associate Member	Qualified to direct work	27 years	8 years	1 year RCA*
Junior	Qualified for sub-professional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years RCM*

* In the following list RCA (responsible charge—Associate Member standard) denotes years of responsible charge of work as principal or subordinate, and RCM (responsible charge—Member standard) denotes years of responsible charge of IMPORTANT work, i. e., work of considerable magnitude or considerable complexity.

FOR MEMBER

Agrawal, Pitam Chand, Sitapur, United Provinces, India. (Age 42.) (Claims RC 16.5, D 15.5.) June 1919 to date with Secretary of State for India, successively as Apprentice Engr., Asst. Executive Engr., and Executive Engr., at present with Sitapur Div., Sarda Canal. (Applies in accordance with Sec. 1, Art I, of the By-Laws.)

Bernhard, Rudolf Karl, State College, Pa. (Age 44.) (Claims RCM 17.0.) Sept. 1938 to date Prof. and Head of Dept. of Mechanics and Materials of Construction, Pennsylvania State Coll.; previously Cons. and Research Engr., Baldwin-Southwark Corporation, Philadelphia, Pa.; Chf. Structural Engr., German State R.R., Berlin, Germany.

Blair, Tom Arthur, Amarillo, Tex. (Age 46.) (Claims RCA 12.7, RCM 12.1.) Since Jan. 1922 with Atchison, Topeka and Santa Fe Ry., as Rodman and Transitman, Office Engr., Bldg. Inspector, Engr. in Chg., Div. Engr., Constr. Engr., Dist. Engr. and at present Chf. Engr.

Bradshaw, Earl Lee, McLean, Tex. (Age 39.) (Claims RC 13.3, D 9.9.) 1938 with U. S. Bureau of Agri. Economics, as Asst. Engr. and Engr. in Chg. McClellan Creek Dam; previously Area Engr., WPA, Dist. 16, Amarillo, Tex.; County Engr., Lamb County, Tex.

Bray, Dwight Hubert (Assoc. M.), Frankford, Ky. (Age 37.) (Claims RC 14.4, D 5.4.) May 1920 to date with Kentucky State Highway Dept. as Draftsman, Instrumentman, Res. Engr., Asst. Dist. Engr., Dist. Engr., Asst. Engr. of Maintenance, and since July 1936 Chf. Engr. (Director) of Maintenance.

Busse, Frank August (Assoc. M.), Memphis, Tenn. (Age 59.) (Claims RC 23.5, D 21.7.) March 1937 to date in private practice, on structural detail plans, design of concrete framework for additions to buildings, etc.; previously Res. Engr. Inspector, PWA, and Dist. Engr., CWA and TERA, Nashville; Associate Engr., Walter F. Schultz, Cons. Engr.

Chase, John Howe (Assoc. M.), Riverside, Calif. (Age 44.) (Claims RCA 1.3, RCM 12.0.) Jan. 1930 to date Cons. Engr. for Fallbrook Public Utility Dist., installing a water system, etc.; for Santa Fe Irrigation Dist. in charge of construction of pumping plants, pipe lines, etc.; and on water development for Moreno Mutual Irrigation Co., and others.

Fabian, Edward Sydney, Knoxville, Tenn. (Age 38.) (Claims RC 8.5, D 4.5.) 1934 to date Instructor, and since 1936 Asst. Prof., of Civ. Eng., Univ. of Tennessee; previously instructor in Civ. Eng., Cornell Univ.

Finch, Herman Francis, Sacramento, Calif. (Age 39.) (Claims RCA 6.1, RCM 6.1.) July 1938 to date Senior Structural Engr., California Div. of Architecture, on structural engineering design; previously with Metropolitan Water Dist. of Southern Calif. as Engr. of Materials and Asst. Engr.

Freeman, Delbert Bliss, Kansas City, Mo. (Age 35.) (Claims RC 9.0, D 3.8.) Jan. 1929 to date with U. S. Engr. Office, successively as Surveyman, Jun. Engr., Asst. Engr., Associate Engr., and at present Engr. in charge of Reservoir Regulation Sec., on studies of Missouri River basin, etc.

Fuellhart, Donald Egbert (Assoc. M.), Natchitoches, La. (Age 38.) Claims RCA 3.6, RCM 10.4.) April 1937 to date Engr., Louisana Dept. of Conservation, Minerals Div.; previously Asst. Agricultural Engr., U. S. Dept. of Agriculture, Soil Conservation Service, ECW; Locating and Res. Engr., Louisiana Highway Comm., Baton Rouge; Engr. with Brokaw, Dixon, Garner & McKee, Geologists and Engrs., New York City.

Guerin, Frederic William, Worcester, Mass. (Age 39.) (Claims RC 6.6.) 1924 to date with Massachusetts Dept. of Public Works as Rodman, Transitman, Constr. Engr., Res. Engr., Supervisor, and at present Div. Constr. Engr. (Senior Civ. Engr.) in charge of flood and hurricane rehabilitation work.

Kendrick, Harry Deckard, Norfolk, Nebr. (Age 40.) (Claims RC 10.2.) May 1935 to date with PWA, Region 4, Omaha, Nebr., as Engr.-Inspector, Engr. Examiner and at present Res. Engr. Inspector; previously Engr.-Inspector, U. S. Engr. Corps, Kansas City and Omaha Districts.

Knowlton, Harry Darwin, Cleveland, Ohio. (Age 44.) (Claims RC 9.6.) Pres., Valuation Service Co., New England Co., and various other companies, reconditioning and maintaining properties (about $175,000 annually); previously Supt., Van Sweringen Co., and member of firm, Knowlton & Howe, Real Estate Operators.

Ledbetter, John Jackson, Jr. (Assoc. M.), El. Paso, Tex. (Age 37.) (Claims RC 13.5, D 8.0.) May 1931 to date Asst. Engr., Associate Engr. and at present Engr., U. S. Sec., International Boundary Comm., United States and Mexico; previously Asst. City Engr., El Paso, Tex., in charge of field work for flood-control study; Office Engr. with Floyd & Lochridge, Cons. Engrs., Dallas, Tex.

Reinert, George Lloyd, Atlanta, Ga. (Age 46.) (Claims RC 11.0, D 12.3.) April 1934 to Feb. 1937 and July 1938 to date Engr.-Examiner, Regional Office, and Res. Engr., Inspection Div., PWA, and Director of Work, ARA, Montgomery, Ala.; Feb. 1937 to July 1938 with Tennessee Coal, Iron & R. R. Co., Ensley, Ala.

Riney, Arthur Herbert (Assoc. M.), Bartlesville, Okla. (Age 50.) (Claims RCA 2.6, RCM 16.4.) Dec. 1919 to date with Phillips Petroleum Co., successively as Supt. of Constr., Chf. Engr., and Vice-Pres. in charge of Eng. Dept.

Sanford, Jasper Hetler, Colorado Springs, Colo. (Age 52.) (Claims RC 18.3, D 6.3.) 1925 to 1933 and 1938 (about 4 months) in private practice, at present as Sanford & Phillips, on construction of Rosemont Dam and Will Rogers Stadium; intervening period Asst. City Engr., Colorado Springs, Colo., acting as Res. Engr. in charge of construction of Crystal Creek and Catamount Dams.

Stickney, Enoch Morgan (Assoc. M.), Mobile, Ala. (Age 45.) (Claims RCA 10.2, RCM 6.8). Aug. 1938 to date Res. Engr., Alabama Highway Dept., in charge of railroad and highway grade separation projects in Mobile County; previously Associate and Vice-Pres., J. B. Converse & Co., Inc., Engrs., Mobile, Ala.

Weiner, Bernard Louis (Assoc. M.), New York City. (Age 39.) (Claims RCA 6.3, RCM 7.8.) Jan. 1935 to date with Madigan-Hyland as Designer, Superv. Designer, etc.; previously Chf. Checker, Landscape Dept., Dept. of Parks, New York City.

FOR ASSOCIATE MEMBER

Alexander, Verne, Oklahoma City, Okla. (Age 32.) (Claims RC 1.6.) Jan. 1931 to date with U. S. Geological Survey, as Jun. Engr., Asst. Hydr. Engr. and at present Res. Engr. in charge cooperative stream gaging for State of Oklahoma.

Ball, Wilfred Nicholas, San Francisco, Calif. (Age 50.) (Claims RC 26.8, D 15.0.) Aug. 1930 to date Fire Insurance Adjuster, Fire Companies' Adjustment Bureau, Inc., since May 1936 being Staff Adjuster on Senior Staff of Gen. Office.

Bauders, Meldon Leo, San Gabriel, Calif. (Age 37.) (Claims RCA 5.1, RCM 0.0.) 1920 to 1924 and 1928 to date with California Div. of Highways, successively as Chainman, Rodman, Instrumentman, Asst. Res. Engr., Jun. Highway Engr., Asst. Highway Engr., and at present Associate Highway Engr., Dist. VII, in charge on highway construction.

Brannan, Thomas Warren (Junior), Columbus, Ohio. (Age 32.) (Claims RC 8.6.) Sept. 1928 to date with State Highway Dept., as Laboratory Asst., Asst. Engr., Soils Laboratory and since July 1930, Highway Testing Laboratory.

Castelazo, Arthur Harrold (Junior), Sacramento, Calif. (Age 32.) (Claims RC 3.4, D 1.5). Sept. 1938 to date Asst. to Contract Supt., PWD, Mare Island, Calif., being Lieut. (jg), CEC, USN, responsible for several contracts for timber and concrete construction; previously with State of California as Asst. Structural Eng. Draftsman, Jun. Bridge Engr., etc.

Dames, Trent Raysbrook (Junior), Los Angeles, Calif. (Age 27.) (Claims RCA 3.1, RCM 0.6.) Aug. 1938 to date in private practice on earthwork and foundation investigations; previously on similar work with R. V.

Labarre, having complete responsible charge of all work on many jobs; Jun. Engr., U. S. Bureau of Reclamation.

Estrada, Alfred Albert, Philadelphia, Pa. (Age 33.) (Claims RC 2.5, D 3.7.) Sept. 1934 to date Asst. Engr., Albright & Friel, Inc., on preliminary survey for tunnel under Schuylkill River, design of water distribution system, sewage-treatment plant, etc.

Ettlinger, William DeRoy (Junior), New York City. (Age 32.) (Claims RC 7.0, D 0.4.) Jan. 1934 to date with WPA on Manhattan sewers as Asst. Chf. of Supply, and at present Work Project Engr. in charge of engineering for sewer construction; previously Engr. with Emil Klein, New York City; Elec. Engr. with George S. Coleman, Washington, D.C.

Hahn, Arthur Robert (Junior), Nutley, N.J. (Age 32.) (Claims RC 5.3, D 3.8.) Sept. 1938 to date Concrete Sales Engr., Massey Concrete Products Corporation, New York City, promotional and service work; previously Road Engr., Metropolitan Life Insurance Co.; Ceramic Sales Engr., Hanley Co., Inc.; Concrete Engr., Portland Cement Ass'n, assisting on construction.

Hale, John Symons (Junior), Spartanburg, S.C. (Age 32.) (Claims RCA 2.7, RCM 0.0.) Nov. 1938 with The Harwood Beebe Co.; previously Jun. Hydr. Engr., Dept. of Interior, U. S. Geological Survey, Water Resources Branch, Montgomery (Ala.) Dist.; Engr. Aide, Bureau of Biological Survey, Washington, D.C.; Transitman, Chf. of Party and Jun. Engr. with U. S. Forest Service, Columbia, S.C.

Harris, Millard Henry (Junior), Birmingham, Ala. (Age 32.) (Claims RC 4.7.) July 1937 to date Res. Engr., Alabama Power Co. at present surveying for and constructing electric transmission lines in Guntersville reservoir area; previously Engr. with U. S. Geological Survey; Field Engr., U. S. Supreme Court's Vermont-New Hampshire Boundary Comm.

Harris, Robert Otis, Mobile, Ala. (Age 42.) (Claims RCA 9.2, RCM 0.0.) Oct. 1933 to date with State Highway Dept., Montgomery, Ala., Transitman, Res. Engr., and since May 1935 Asst. Div. Engr. in charge of maintenance.

Hopkins, William Joseph (Junior), Pittsburgh, Pa. (Age 32.) (Claims RC 4.5, D 1.5.) March 1937 to date Asst. Engr., U. S. Engr. Office, on Pittsburgh flood-control project, at present Head of Model Studies Sec.; previously Chf. Draftsman and Designer with R. F. MacDowell, Cons. Engr.; Asst. Engr., Engr. Corps, U. S. Army, Huntington Dist., on design of Bluestone Dam and hydraulic-power studies.

Hubbell, Charles Wheeler (Junior), Bartlesville, Okla. (Age 32.) (Claims RC 9.0, D 1.3.) June 1926 to date with Phillips Petroleum Co., as Mech. Draftsman, Instrumentman, Inspector, Map Draftsman, Dist. Supt. for Eng. Dept., Asst. to Supt. of Constr. Div. of Eng. Dept., and at present Asst. to Supt. of Design Div. of Eng. Dept.

Johnson, Max Roland (Junior), Antioch, Calif. (Age 32.) (Claims RCA 4.4, RCM 0.0.) June 1930 to date with U. S. Bureau of Reclamation, successively as Instrumentman (actually Chf. of Party), Jun. Engr., and at present Asst. Engr. at Antioch, Calif. acting as Chf. Inspector, with some duties of Res. Engr., on construction of Contra Costa Canal, Central Valley Project.

Little, Walter Burgess, Seattle, Wash. (Age 29.) (Claims RC 1.6, D 0.3.) April to Oct. 1936 and July 1938 to date with Washington State Highway Dept. as Draftsman, Instrumentman and Inspector on highway construction, at present Bridge Designer; previously Instructor, Univ. of Washington; acting Res. Engr., California Highway Dept.

Little, William Seelye (Junior), Rochester, N.Y. (Age 32.) (Claims RC 3.5.) Nov. 1934 to date Draftsman and Surveyor, Eastman Kodak Co.; previously Asst. Supt. TERA, CWA, and Genesee State Park Comm., on construction of parkway along Lake Ontario.

McCarthy, Gerald Timothy (Junior), Scranton, Pa. (Age 29.) (Claims RC 7.6, D 6.4.) May 1931 to date with U. S. Engr. Corps successively as Jun. Engr. for St. Louis Dist., Associate Engr. for Zanesville (Ohio) Dist., Engr. for Eastport (Me.) Dist., and Engr. and Senior Engr. for Providence (R.I.) Dist. on Connecticut River flood-control project.

Massey, Palmer, Childress, Tex. (Age 38.) (Claims RCA 9.2, RCM 4.0.) May 1932 to date Res. Engr. and Asst. Div. Engr., Texas Highway Dept., on bridges, drainage structures, etc.; previously Res. Engr., Texas and Oklahoma Highway Dept.

Mauzy, Harris Kenneth (Junior), Livingston, Calif. (Age 32.) (Claims RCA 2.5, RCM 0.0.) Sept. 1930 to date with California Div. of Highways as Draftsman, Jun. Highway Engr., and at present Asst. Highway Engr., Bridge Dept.

Meyers, J. Stuart (Junior), Rock Island, Ill. (Age 32.) (Claims RCA 3.7, RCM 2.0.) June 1928 to Oct. 1929 and Feb. 1934 to date with U. S. Engr. Office, successively as Surveyman, Jun. Engr., Asst. Engr. and Associate Engr., being Asst. Chf. of Hydr. Sec.; previously with U. S. Waterways Experiment Station, Vicksburg, Miss.

Moore, Charles Herbert (Junior), Sheboygan, Wis. (Age 32.) (Claims RC 3.9, D 0.3.) June 1938 to date Draftsman, Jerry Donohue Eng. Co., on PWA work; previously Draftsman and Inspector with Greeley & Hansen; Associate Engr., U. S. Army Engr. Office, Conchas Dam. N.Mex.

Murray, Franklin Randolph, Cave City, Ky. (Age 31.) (Claims RCA 5.7, RCM 0.0.) May 1934 to date with U. S. Dept. of Interior as Engr. Foreman and since Aug. 1936 Asst. Engr., Mammoth Cave National Park, Ky.

Newnam, Frank Hastings, Jr., Austin Tex. (Age 29.) (Claims RC 7.0, D 3.6.) July 1931 to date with Texas State Highway Dept. as Tech. Asst. in charge of soils, Testing Laboratory, Subgrade Tester, and at present Research Asst. in active charge of research work on soils and base materials.

Porteus, John Horton, Cambridge, Mass. (Age 30.) (Claims RCA 3.5, RCM 0.5.) May 1937 to date with Jackson & Moreland, as Engr. in charge of design for rigid steel frame of L Street Power House (1937 extension), and at present Design Engr. in charge of structural and architectural work on power plant; previously Senior Eng. Aide to Worcester County Engr.; Chief Instrumentman, U. S. Coast & Geodetic Survey.

Raatz, Walter Arthur (Junior), Galveston, Tex. (Age 30.) (Claims RCA 0.5, RCM 1.2.) July 1937 to date Asst. Engr., Galveston, (Tex.) Wharf Co., preparing designs and supervising construction of concrete, steel and timber docks; previously with Texas State Highway Dept., Austin, Tex., as Tracer, Draftsman and Asst. Engr.

Rawlins, George Skevington, Charlotte, N.C. (Age 34.) (Claims RC 6.1, D 6.3.) April 1937 to date Engr., in charge of water-works improvements, City of Charlotte; previously Engr. with The Chester Engrs., Pittsburgh, Pa.; Engr. Wm. H. Dechant & Sons, Reading, Pa.

Reid, Lincoln, New York City. (Age 33.) (Claims RC 2.1.) Feb. 1938 to date Instructor in Civ. Eng., Coll. of City of New York; previously Jun. Engr., U. S. Bureau of Reclamation, Denver, Colo., in Spillway Design Sec. and later in Hydr. Research Div.

Scott, John Kuhn, Pittsburgh, Pa. (Age 57.) (Claims RCA 10.0, RCM 0.0.) July 1938 to date Senior Design Draftsman, Dept. of Public Works, Pittsburgh, Pa., in charge of specifications for PWA projects; previously with Bureau of Eng., Pittsburgh, inspecting sewers and test-hold drillings; Insurance Solicitor, Fidelity & Casualty Co. of New York.

Stephens, Charles Henry (Junior), Dayton, Ohio. (Age 32.) (Claims RCA 10.0, RCM 0.0.) Oct. 1923 to date with Dept. of Water, Dayton, Ohio, successively as Rodman, Levelman, Draftsman, Transitman and Inspector on water mains, Res. Engr. in charge of engineering and construction of sewage-pumping station, at present Asst. Engr. in responsible charge of engineering and construction of water-supply project.

Teter, George Staudt (Junior), Brooklyn, N.Y. (Age 32.) (Claims RC 10.7, D 6.0.) Feb. 1928 to date Secy. and Gen. Mgr., Brisk Waterproofing Co., Inc., New York City, in complete charge of estimating, design and execution of contracts for waterproofing of buildings, etc.; previously Asst. Supt., Newark, (N.J.) Concrete Pipe Co.

Twinem, Joseph Conrad (Junior), Cripple Creek, Colo. (Age 32.) (Claims RCA 0.4, RCM 6.2.) June 1934 to date Mine Operator, Geneva-Matoa Consolidated Gold Mines, Cripple Creek, Colo., being Gen. Supt., Mining Engr. and Surveyor, also (concurrently) Chf. Constr. Engr., E. L. Sweeney Constr. Co., Denver, Colo., on their Cripple Creek, Colo., project; previously State Geologist of Maine.

Varney, Forrest Franklin, Sacramento, Calif. (Age 46.) (Claims RCA 16.0, RCM 0.0.) April 1929 to date Engr. and Supt., Firebaugh (Calif.) Canal Co., in charge of operation and maintenance of Mutual Canal Co.; previously Asst. Engr. on surveys, design, etc., for Kern River Water Storage Dist.

Waldron, Heber Grafenstein (Junior), Valley City, N.Dak. (Age 32.) (Claims RCA 2.0, RCM 0.0.) Sept. 1933 to date with North Dakota State Highway Dept. as Rodman and Instrumentman, and at present Res. Engr., acting as Office Engr. or Engr. Asst.

Willier, George Joseph (Junior), St. Louis, Mo. (Age 32.) (Claims RC 7.1.) Jan. 1937 to date Engr., Sales Dept., Sheffield Steel Corporation, Kansas City, Mo.; previously Asst. Valuation Engr., Union Elec. Light & Power Co., St. Louis, Mo.

FOR JUNIOR

Bluestone, Enoch, New York City. (Age 24.) 1938 C. E., Cornell Univ.; now Draftsman, Weinberger & Rodd, Structural Engrs.

Farmer, Fred Marshall, Ephrata, Wash. (Age 31.) Senior Computer, Bureau of Reclamation; previously Inspector, Bureau of Reclamation, Coulee Dam, Wash.; Transitman, MWAK Co., Grand Coulee Dam; Draftsman and Bridge Inspector, St. Louis County (Minn.) Highway Dept.

Fox, Jeff Stanley, Cleburne, Tex. (Age 27.) (Claims RC 3.0.) 1938 B.S. in C.E., Univ. of Tex.; now and prior to graduation with Texas State Highway Dept. as Instrumentman, supervising construction grading and drainage structure job and construction of large bridges.

Guess, Samuel Cain, Vicksburg, Miss. (Age 29.) (Claims RCA 1.6 RCM 0.0) Oct. 1937 to date Jun. Engr., Mississippi River Comm. being Eng. Asst. making hydraulic studies; previously with U. S. Engr. Office and U. S. Waterways Experiment Station, as Surveyman, Inspector, Jun. Engr., etc.

Hicks, Newton Franklin, Omaha, Nebr. (Age 24.) 1938 B.S. in A.E., Univ. of Nebr.

Luecker, Arthur Rowe, Iowa City, Iowa. (Age 22.) 1937 B.S. in Civ. Eng., Univ. of Wis. Sept. 1937 to date graduate student, and Research Asst., State Univ. of Iowa.

MacKay, Harry Fraser, Portland, Ore. (Age 25.) 1938 completed requirements for B.S. in C.E., Oregon State Coll. (degree to be conferred in June 1939); at present with Columbia National Forest on civil engineering; July 1935 to Oct. 1936 Draftsman, U. S. Engr. Office; previously Prin. Asst. and Draftsman, U. S. Public Survey Office; Inspector, Eng. Dept., Columbia Construction Co.

Murphy, Gerard Joseph, Brooklyn, N.Y. (Age 26.) 1938 B.S. in C.E., Univ. of Wyo.

Neff, Paul Emil, New York City. (Age 22.) 1937 B.C.E., and 1938 M.C.E., Coll. of City of N.Y.

Ohman, Richard Nelson, Minneapolis, Minn. (Age 27.) 1938 C.E., Univ. of Minnesota; now with WPA as Eng. Aide.

Selim, Mohamed Ahmed, Berkeley, Calif. (Age 26.) (Claims RC 0.2, D 1.3.) Aug. 1938 to date graduate student, Univ. of California (sent by Egyptian Univ.); previously Asst., Irrigation Sec., Faculty of Engineering, Egyptian Univ., Cairo, Egypt; Engr., Eng. Office, Ports & Lights Administration, Alexandria, Egypt.

Shipley, John Robert, Knoxville, Tenn. (Age 24.) 1938 B.S. in Civ. Eng., Univ. of Tenn.

Siwik, Francis John, Brooklyn, N.Y. (Age 23.) 1937 B.C.E., and 1938 M.C.E., Coll. of City of N.Y.

Smith, George William, Sacramento, Calif. (Age 29.) Sept. 1927 to date with California Dept. of Public Works, Bridge Dept., Div. of Highways, acting as Asst. Res. Engr., Chf. of Party, and at present on office work for preliminary surveys for bridge and grade separation structures, etc.

Spohr, Charles Dolbeer, Baytown, Tex. (Age 24.) 1938 B.S. in C.E., Va. Mil. Inst.; now Student Engr., Humble Oil & Refining Co.

Sundholm, Olaf Armas, Brooklyn, N.Y. (Age 23.) Sept. 1937 to date graduate student in Civ. Eng., Brooklyn Polytechnic Inst.; at present also Concrete Detailer, Ceco Steel Products Corporation, Jersey City, N.J.

Sundstrom, Harald Joseph, Louisville, Ky. (Age 28.) (Claims RCA 1.0, RCM 0.0.) May 1934 to date with U. S. Engrs., successively as Inspector and Eng. Aide, Jun. Engr., and at present Prin. Eng. Aide on design of flood-control structures, etc.

Taylor, Robert Louis, Ocala, Fla. (Age 27.) (Claims RC 0.2.) 1938 B.S. in C.E., Univ. of Fla.; now with U. S. Geological Survey.

Thornbury, Harry Thomas, Jr., Astoria, N.Y. (Age 21.) 1938 B.C.E., N.Y. Univ.; now Transitman, Topographical Bureau, Queens, New York City, also drafting.

The Board of Direction will consider the applications in this list not less than thirty days after date of issue.

Installing cast iron pressure sewer at Highland Park, N. J.

THE USE of cast iron pipe for important sanitary mains, an unfamiliar application to many engineers a decade ago, is fast becoming standard practise. Today's need is a material which successfully combats acid trade waste, effectively resists exterior corrosion and has great beam and crushing strength. These factors of permanency must be supplemented by joints that are tight and stay tight. Economical and efficient operation of treatment plants demands infiltration-proof influent lines. Cast iron pipe meets all these requirements. Address inquiries to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago.

CAST IRON PIPE

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

Hard Soil Can't Stop

UNION METAL
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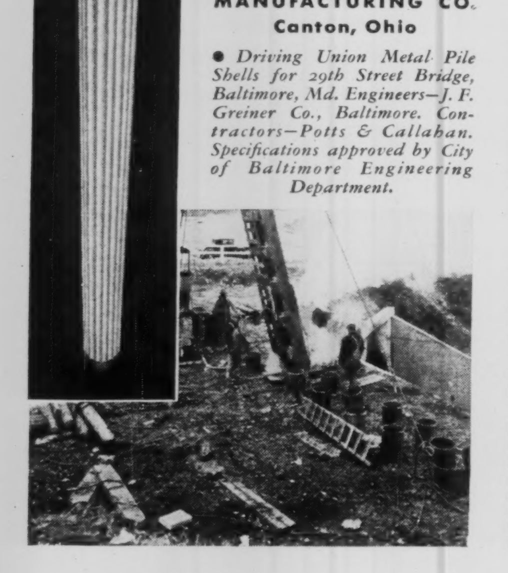
• Tough driving holds no terror for Union Metal Pile Shells. They are fabricated by the cold rolling process for added abrasive and impact resistance. Fluted design gives them great stiffness and rigidity in addition to increasing their bearing value.

Union Metal Pile Shells require no core or mandrel. That means faster driving, regardless of soil conditions, because reduced weight of shell enables full force of hammer to be transmitted directly to the driving point. These light weight shells are easily handled and can be driven with ordinary crane, standard leads and light hammer.

Thousands of these shells have been driven on difficult foundation jobs in all parts of the country. Many such jobs are illustrated in the new Union Metal piling catalog. Write for it today.

THE UNION METAL MANUFACTURING CO.
Canton, Ohio

• Driving Union Metal Pile Shells for 29th Street Bridge, Baltimore, Md. Engineers—J. F. Greiner Co., Baltimore. Contractors—Potts & Callahan. Specifications approved by City of Baltimore Engineering Department.



Building Codes, Chicago. Chicago Building Code Advances. *Eng. News-Rec.*, vol. 119, no. 13, Sept. 23, 1937, pp. 512–523. Review of progress in revision of Chicago building code, with special reference to foundations, wood construction, and reinforced concrete.

Difficult Sites. Modern Treatment of Foundations on Difficult Sites, B. Green. *Surveyor*, vol. 91, no. 2359, Apr. 9, 1937, pp. 523–524. Objections to deep piers; heavy raft foundations; uniformity of settlement; safe pressures; soil changes during excavation.

New Orleans. Some Data in Regard to Foundations in New Orleans and Vicinity Collected and Compiled by Soil and Foundation Survey as Requested by Louisiana Engineering Society. New Orleans, La., Works Progress Administration Project, vol. 1, 1937, 277 pp., supp. plates. Geologic formation of district; data on test borings, spread footings, and foundations; study of pile foundations.

Testing. Foundation Exploration in Deep Water, A. L. Dow. *Eng. News-Rec.*, vol. 119, no. 16, Oct. 14, 1937, pp. 635–640. Methods of soil sampling and core drilling successfully carried on in deep and swift-moving tidal waters of Passamaquoddy Bay with floating equipment; marine equipment; arrangement of boring rig which had to accommodate itself to 24-ft change in water level; load tests; working crews.

Viaducts, Underpinning. Underpinning a Busy Railroad Viaduct. *Eng. News-Rec.*, vol. 119, no. 12, Sept. 16, 1937, pp. 481–483. Method of underpinning viaduct approach to Detroit Union Terminal to protect it against possible settlement from driving of new intercepting sewer; types of pick-up assemblies; pile driving.

HYDROLOGY AND METEOROLOGY

Earthquakes. Sensible Earthquakes in Tokyo for Period July 1–December 31, 1936. *Tokyo Imperial Univ.—Earthquake Research Inst.—Seismometrical Report*, pts. 3 and 4, 1936, pp. 7–13. Tabular data; map showing distribution of epicenters of sensible earthquakes in Tokyo for July 1 to Dec. 31, 1936.

Washington, D.C. Study of Weather in Washington, D.C., M. O. Soroka. *Heating & Vent.*, vol. 34, no. 9, Sept. 1937, pp. 52–56. Not only are figures relating to extreme conditions of concern to air-conditioning engineers, but such work requires detailed knowledge of day-by-day weather; information on weather in one large city presented in hope that engineers having such data may be moved to publish similar information for other important cities.

INLAND WATERWAYS

Rivers, Development. $75,000,000 Conservation Plan for Willamette River Basin, C. I. Grimm. *West. Construction News*, vol. 12, no. 1, Jan. 1937, pp. 24–26. Review of investigations on development of water resources of valley for combined interest of navigation, irrigation, flood control, power development, and stream purification, carried out by U. S. War Department; proposed dam and storage program; stream pollution; initial development.

IRRIGATION

Canada. Irrigation Engineering, S. G. Porter. *Eng. J.*, vol. 20, no. 6, June 1937, pp. 403–414. Semicentennial paper of 50 years of Canadian achievement in engineering and industry. Before Eng. Inst. Canada.

Canals, Construction. Casper Canal Progress. *Eng. News-Rec.*, vol. 119, no. 18, Oct. 28, 1937, pp. 705–710. Progress report on construction of irrigation canal 59 miles long, including several tunnels of large section for irrigation of 35,000 acres of Kendrick irrigation project in Wyoming; low cost on grading established by four large electric draglines; drill-hole arrangement used in driving tunnels; tunnel lining; siphons carrying canal under major cross-drainage channels.

Weed-Control. Weed-Control by Burning Along Irrigation Ditches, C. W. Lillywhite. *West. Construction News*, vol. 12, no. 3, Mar. 1937, pp. 92–93. Experience of Salt River Valley Water Users' Assn. with weed burning as method of controlling vegetation growth along irrigation ditches; recommendations.

MATERIALS TESTING

Concrete, Permeability. Simple Test for Water Permeability of Concrete, G. Wiley and D. C. Coulson. *Am. Concrete Inst.—J.*, vol. 9, no. 1, Sept.-Oct., 1937, pp. 65–75. Outline of original method for determining permeability of concrete which is alleged to be cheaper and simpler in construction and operation than those previously employed; effect of increasing fineness of cement; effect of permeability of using cement ground with dispersing agent.

Soils. Exploration of Soil Conditions and Sampling Operations, H. A. Mohr. *Harvard Univ.—Publ.*, no. 208, June 1937, 45 pp. Instructions on soil testing; field identification and classification of soils; methods of underground exploration for foundation purposes; test pits and test caissons; jet probings, driven pipes, and other methods; geophysical methods; analysis of typical examples.

PORTS AND MARITIME STRUCTURES

Africa. Le port d'Abidjan, Blosset. *Travaux*, vol. 21, no. 53, May 1937, pp. 189–198. Construction of new breakwaters, piers, and other structures in port of Abidjan on Ivory Coast West Africa; results of elaborate hydraulic model tests of proposed structures, made at Hydraulic Laboratory of Delft, Netherlands.

Boston. New England Maritime Activity and Port of Boston, F. S. Davis. *Naut. Gaz.*, vol. 127, no. 19, Sept. 11, 1937, pp. 6–7, and 30. Progress in maritime affairs in recent years; commerce of port of Boston and improvement of its facilities for handling water-borne commerce discussed.

China. New Harbour Works in China. *Engineer*, vol. 164, no. 4257, Aug. 13, 1937, p. 182. Brief account of some important works carried out in recent years; it is pointed out that there is grave danger that Chinese Central and Provincial governments may be led to undertake expensive and non-productive engineering schemes of grandiose nature.

Design. Tolerances and Reinforcing for Tilted Cylindrical Piers, R. H. Chambers. *Eng. News-Rec.*, vol. 119, no. 15, Oct. 7, 1937, pp. 606–607. Discussion of three cases in New York City varying widely in treatment of out-of-plumb deep caissons; varying tolerance specifications; proposed specifications.

Erosion, California. Coast of California as Beach Erosion Laboratory, M. P. O'Brien. *Shore & Beach*, vol. 4, no 3, July 1936, pp. 74–79. Study of erosion on California beaches; geology and hydrography; physical influences; beach characteristics; research; beach problems and preservation work.

Erosion, North Carolina. Comprehensive Coastal Development Project in North Carolina. *Shore & Beach*, vol. 4, no. 3, July 1936, pp. 94–98. Features of seven Works Progress Administration beach-erosion-prevention projects for North Carolina to cost $1,368,742; purposes of sand control; methods proposed; inlet improvements; highway and bridge construction; development of fisheries.

Marine Drift. Action of Marine Drift, C. J. Van Mierlo. *Shore & Beach*, vol. 4, no. 3, July 1936, pp. 99–100, and vol. 5, no. 2, April 1937, pp. 56–62. July: Nature and effect of drift. April: Means of defense; distribution of drift in water; wind and waves; mechanism of drift. Translated from *Annales de l'Association des Ingênieures*, 1916.

ROADS AND STREETS

Construction. Derelict Railway Formation for New U.S.A. Highway. *Ry. Gaz.*, vol. 67, no. 13, Sept. 24, 1937, pp. 526–527. Partly completed "South Penn" Railroad earthwork, bridges and tunnels are to be widened and made up for new superhighway from near Pittsburgh to near Harrisburg, through Allegheny Mountains in Pennsylvania. Previously indexed from *Eng. News-Rec.*, July 29, 1937.

Construction, Blue Ridge Parkway. Mountain Road Builders Grade 140 Miles of Route for Blue Ridge Parkway. *Construction Methods & Equipment*, (formerly *Construction Methods*), vol. 19, no. 1, January 1937, pp. 44–48. Review of construction conditions and progress on 16 contract sections of projected Blue Ridge Parkway, 500 miles in length, connecting Shenandoah National Park in Virginia with Great Smoky Mountains National Park in North Carolina; grading equipment; costs.

Design. Highway Location in Southern Ontario, C. H. Fulton. *Can. Engr.*, vol. 72, no. 20, May 18, 1937, pp. 13–17. Methods of locating 4-lane central boulevard type of highway adopted by Ontario Department of Highways; alignment and grade; standard cross-sections; features of location survey; advantages of boulevard. Before Can. Inst. Surveying, Ottawa.

Drainage. Methods of Subgrade Drainage, H. E. Cotton. *Roads and Streets*, vol. 80, no. 5, May 1937, pp. 61–64, 66, 68, and 70. Review of subdrainage practice; free ground-water conditions; kinds of drains; highway intercepting drain; airport surface drains; infiltration openings; location and depth of highway subdrains; slides; breakups due to longitudinal seepage; cut-slope stabilization; level water-table conditions. Paper before Am. Road Bldrs.' Assn.

Highway Systems, Germany. New German Highway System, J. Poulter. *Roads and Streets*, vol. 80, no. 5, May 1937, pp. 31–35. Design and construction of new German system of superhighways.

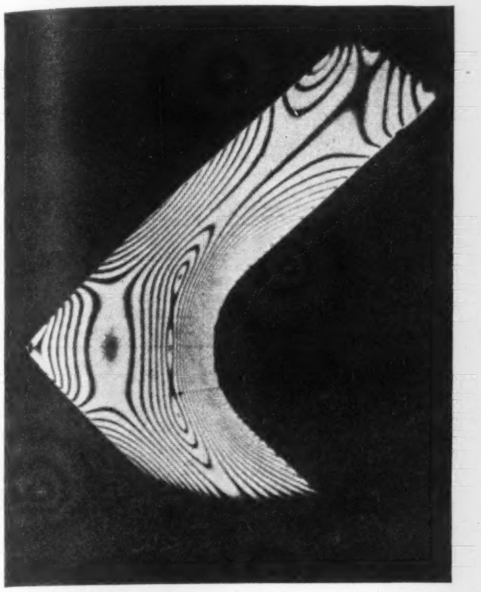
Highway Systems, Louisiana. Louisiana Highways. *Better Roads*, vol. 7, no. 1, January 1937, pp. 23–26. Development of Louisiana state highway system; review of highway construction and maintenance practice; state highway patrol; planning and research.

Highway Systems, Mexico. Great Modern Highway in Mexico, C. M. Upham. *Better Roads*, vol. 7, no. 1, January 1937, pp. 48 and 50. Non-technical description of Mexico section of Pan-American Highway.

Highway Systems, North Carolina. North Carolina Highway Problems—Observations on

Polaroid — *for Stress Determination*

with LARGE Aperture PHOTOELASTIC POLARISCOPE



Angle Plate under Stress

The illustration shows an instrument of 4¼ aperture mounted on an optical bench one meter long. The four units are:

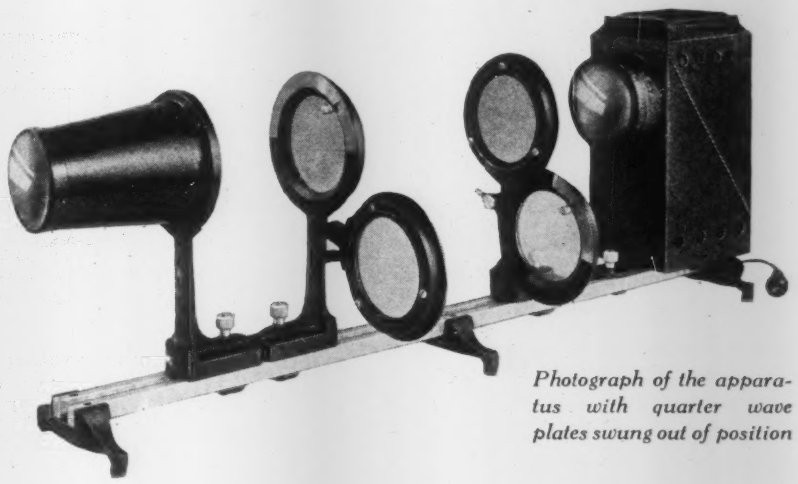
- The Light Source, consisting of illuminant, filter for 5461 Å (with mercury light), condenser and collimating lens, within a single compact unit.
- The Polarizer and quarter wave plate mounted in unit on a single rider but calibrated and rotated independently of each other.
- The Analyzer and quarter wave plate similar to Polarizer.
- The Projection system.

The polarizer and analyzer are set in rotating mounts with scale reading for 180°; the quarter wave plates are in rotating mounts with scale reading for 90°.

By this unique arrangement, this new model with its simplified construction facilitates photoelastic investigation. For taking the isoclinics, the quarter wave plates are merely swung out of position; for photographing the stress fringes, the quarter wave plates are swung back into position and automatically, into correct optical alignment. At all times, every part of the set-up is fixed in correct optical alignment.

The simplicity of the instrument is accentuated by the fact that there are no lenses in any position between the polarizer and the analyzer, eliminating inaccuracies caused by strained lenses, or depolarization which occurs at the edges of lenses.

The 4¼" aperture with "white" light source is priced at $300.00



Photograph of the apparatus with quarter wave plates swung out of position

DON'T GUESS AT AREAS OF STRESS CONCENTRATION! *See them visually.* DON'T GUESS AT AMOUNT OF STRESS! *Measure it quantitatively.* Axial loads do not always cause uniform stress distribution. The dimensions of a part are not necessarily an indication of its strength. Testing machine parts to the point of breakdown and thus approximating stress data can lead to conclusions which are at considerable variance from actual conditions.

The importance of photoelasticity for stress determination has been known for some time but in many cases, use has not been made of it because of the many objections to the Nicol prism arrangement to which one was limited prior to the development of Polaroid. In contrast to the complex apparatus heretofore used is the Polaroid-equipped photoelastic polariscope which is simple in construction, convenient for use and much lower in cost.

The change in design has been made possible only by the development of large area polarizing media and large area quarter wave plates. Standard sizes are available in apertures of 4¼", 6¼", and 8¼"; special sizes can be had up to 12" aperture. The light source may be ordinary light or mercury light (fitted with filter for 5461 Å). And for those who wish to construct their own apparatus, we will furnish any of the parts.

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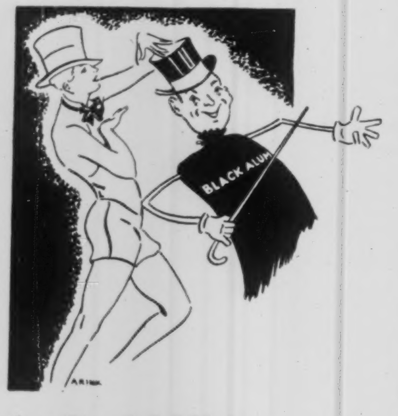

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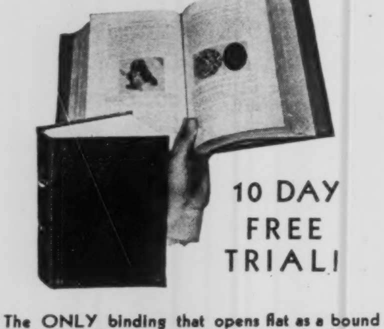

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Certain Phases, V. J. Brown. *Roads & Streets*, vol. 80, no. 4, May 1937, pp. 41–46. Growth of state system; types of highways in North Carolina state system; maintenance of state highways; average annual maintenance expenditures in dollars per mile; county road problem; bad roads tax; miles covered by average North Carolina passenger car; relative cost of motor-vehicle operation as affected by condition of road surface.

STREET LIGHTING. New Methods in Street Lighting Research, H. H. Ballin. *Light and Lighting*, vol. 30, no. 9, Sept. 1937, pp. 249–252. B.S.S. Specification; road lighting and road inspection; brightness meters; photographic brightness records; perspective views of installations; appearance of lighting units; lighted roadway; problem of glare; tests of components of street-lighting units.

SEWERAGE AND SEWAGE DISPOSAL

BRICK SEWERS. Abrasive Action of Sewerage on Brick Sewers, H. C. Plummer. *Am. Cer. Soc.—Bul.*, vol. 16, no. 9, September 1937, pp. 365–368. Paper presents data obtained in inspection of three brick sewers constructed in Cleveland approximately fifty years ago; bricks in invert were inspected for erosion, and brick samples were taken from sewer and were tested for absorption, compressive strength, and modulus of rupture; review of known similar investigations given.

DISPOSAL, NEW YORK. New York Adds Another Sewage Plant. *Eng. News-Rec.*, vol. 119, no. 14, Sept. 30, 1937, pp. 541–545. Design and construction of 40-mgd Tallmans Island activated sludge plant, which will end pollution of Flushing Bay; utilization of by-products gas as aid to internal-combustion engine units producing 3,500 hp; estimated cost $4,100,000; development of site; factors affecting flow; pump and blower house; sedimentation and aeration; final sedimentation tanks; sludge storage and disposal.

DISPOSAL PLANTS, MAINTENANCE AND REPAIR. Maintenance of Sewage Comminutors, A. C. Durdin and M. Spiegel. *Am. City*, vol. 52, no. 10, October 1937, p. 95. Cutter inspection and lubrication.

DISPOSAL PLANTS, OPERATION. Three Methods of Aeration in One Activated Sludge Plant, T. R. Kendall. *Am. City*, vol. 52, no. 4, April 1937, pp. 63–65. Operation of 9-mgd sewage-treatment plant of London, Ontario; removal of grit and screenings; methods of screening; three types of aeration; sludge handling; air-compression units; experimental work with horizontal sludge filter.

DISPOSAL, SOUTH AFRICA. Johannesburg's Sewage Works. *Engineer*, vol. 163, no. 4249, June 18, 1937, pp. 693–695 and 702. Brief descriptions of Klipspruit sewage farm; Antea disposal works; Cydna and Delta disposal works; Delta works put into operation in 1935; electrically produced ozone for oxidizing impurities in foul air is mixed with air exhausted from this chamber before being discharged to atmosphere.

DISPOSAL, UNITED STATES. Sewage Disposal in Pacific Northwest, C. E. Green. *Sewage Works J.*, vol. 9, no. 4, July 1937, pp. 615–618. General review of sewage disposal practice in Idaho, Oregon, and Washington. Before California Sewage Works Assn.

SANITARY ENGINEERING, GREAT BRITAIN. Engineering and National Health Services. *Engineering*, vol. 144, no. 3735, Aug. 13, 1937, pp. 182–183. Review of 18th annual report of Ministry of Health, 1936–1937, London, H. M. Stationery Office, price 5s net; reference made to report on water supply, sewerage, and sewage disposal, public cleansing, atmospheric pollution, and town planning.

SLUDGE DIGESTION. High and Low Temperature Digestion Experiments. III—Effect of Certain Organic Wastes, W. Rudolfs and L. R. Setter. *Sewage Works J.*, vol. 9, no. 4, July 1937, pp. 549–568. Laboratory experiments on large number of sewage-sludge and organic trade-wastes mixtures, at high and low temperatures, to determine relative effects of different trade wastes, added in varying concentrations, on digestion time, gas production, gas composition, odors, drainability, and possible "acclimating" of sewage sludges to definite wastes.

STRUCTURAL ENGINEERING

BEAMS, DEFLECTIONS. Beam Deflections Without Integrating, K. Hajnal-Konyi. *Eng. News-Rec.*, vol. 119, no. 17, Oct. 21, 1937, pp. 673–674. Direct application of Mohr's theorem to beams with any support conditions to determine beam deflections; bending moment load example; deflection of simply supported beam due to moment load at one support; deflection of simply supported beam due to concentrated load; deflection of fixed-end beam due to concentrated load.

ROOF TRUSSES, DESIGN. Construction Design Chart—XV—Roof Truss Stresses, J. R. Griffith. *West. Construction News*, vol. 12, no. 3, Mar. 1937, p. 117. Construction of alignment chart for computing stresses in eight-panel Fink truss, one-quarter pitch.

TUNNELS

CAISSON DISEASE. Diving Research and Its Application to Caisson and Tunnel Work, G. W. M. Boycott. *Engineer*, vol. 164, no. 4254, July 23, 1937, pp. 93–95. Author's experience with compressed air work and sickness; table giving first few lines of tables used by writer in working out decompressions; method employed of administering oxygen to divers is to lower submersible airlock to meet diver at depth of 60 ft.

CONSTRUCTION, WELDING. New Lincoln Tunnel, M. P. Korn. *Welding J.* (N.Y.), vol. 16, no. 9, September 1937, pp. 6–7. Typical details of new shop-welded built-up segments; 60 in. wide; cast-iron and cast-steel segments are 30 in. wide; complete welded tunnel ring is made up of 11 built-up segments and built-up key; cast-iron and steel rings require 14 standard segments and key.

VEHICULAR, FRANCE. Le tunnel de Saint-Cloud, De Buffevent. *Travaux*, vol. 21, no. 56, August 1937, pp. 333–336. Description of flat arch vehicular tunnel, 830 m long, 17 m wide, now in course of construction at Saint-Cloud, Paris, France; method of excavation.

VEHICULAR, LINING. Field Measurement and Study of Stresses in Tunnel Lining, G. M. Rapp and A. H. Baker. New York City, Port of New York Authority Engineering Dept. July 1937, 96 pp., tables, diagrs. Investigation of stresses in cast-iron lining of Lincoln Tunnel by measurements of strains during construction; correlation of pressures and stresses; statistical study of stresses; laboratory tests of full-sized sections of tunnel lining.

WATER RESOURCES

WATER SUPPLY, SURVEY. Inland Water Survey of Great Britain, R. G. Hetherington. *Engineer*, vol. 164, no. 4252, July 9, 1937, pp. 53–54. Discussion of structure, agents, standards, direction and control of survey, interpretations of results obtained, inspectional arrangements, financial considerations, and character of results of survey. From Brit. Water Works Assn.

WATER WORKS ENGINEERING

AIR CONDITIONING, WATER SUPPLY. Condensing Water for Air Conditioning City Hall Is Put Back in Supply Main, J. Stocker. *Heating, Piping & Air Conditioning*, vol. 9, no. 9, September 1937, pp. 548–549. At Oklahoma City's new city hall, condensing water for refrigerating condenser of air-conditioning plant is taken from city main, passed through condensers, and returned to main; under supervision of city water department, tests of contamination and temperature readings are being taken, and idea of permitting private installations is being considered.

FIRE SERVICE. Cost of Fire Protection Built Into Water Works, H. R. F. Helland. *Am. City*, vol. 52, no. 9, September 1937, pp. 69–71. Discussion of reduced insurance rates versus additional cost of domestic supply for fire service; cost of water system for domestic service only compared to enlarged system including fire protection; resultant key insurance-rate reductions. From Cast Iron Pipe News.

GERMANY. Water Supply in Germany. *Water & Water Eng.*, vol. 39, no. 477, April 1937, pp. 223–224. Review of recent progress in development of water works in Germany.

MONTREAL. History of Water Works at Montreal, C. J. Des Baillets. *Can. Engr.*, vol. 72, nos. 18 and 22, May 4, 1937, pp. 9–14, and June 1, pp. 11–12. May 4: History of Montreal water works since 1800 and description of system as of 1936; Montreal filtration works; low-level pumping station; new McTavish pumping station. June 1: Construction of present system commenced in 1920; trunk mains; cost of operation of filtration works and pumping stations.

ROME, ITALY. L'approvvigionamento idrico di Roma e il nuovo acquedotto del Peschiera, E. Casalini. *Ingegnere*, vol. 15, no. 8, August 1937, pp. 361–372. Review of development of water works of modern Rome and outline of Peschiera Springs project to supply flow of 4,000 liters per sec.

SICILY. L'acquedotto di Montescuro in Sicilla, A. Di Napoli. *Annali dei Lavori Pubblici*, vol. 75, no. 7, July 1937, pp. 599–612. Design and construction of Montescuro aqueduct system having total length of 220 km, carrying total flow of 159 liters per sec to serve number of communities in territory between Palermo and Agrigento, on island of Sicily, having total population of 190,000; details of S. Cristoforo concrete gravity dam, about 40 m. high.

WATER WELLS, AMARILLO, TEX. Experience with Wells in Fine Sand, E. T. Archer. *Eng. News-Rec.*, vol. 119, no. 12, Sept. 16, 1937, pp. 471–472. Ten years' experience with well system of Amarillo, Tex., showing that problem of obtaining continuous supply of water from fine sand and silt formations has been solved successfully; capacity of well system increased by continuous gravel walling and recharge of ground water by impounding; open screens in wells.

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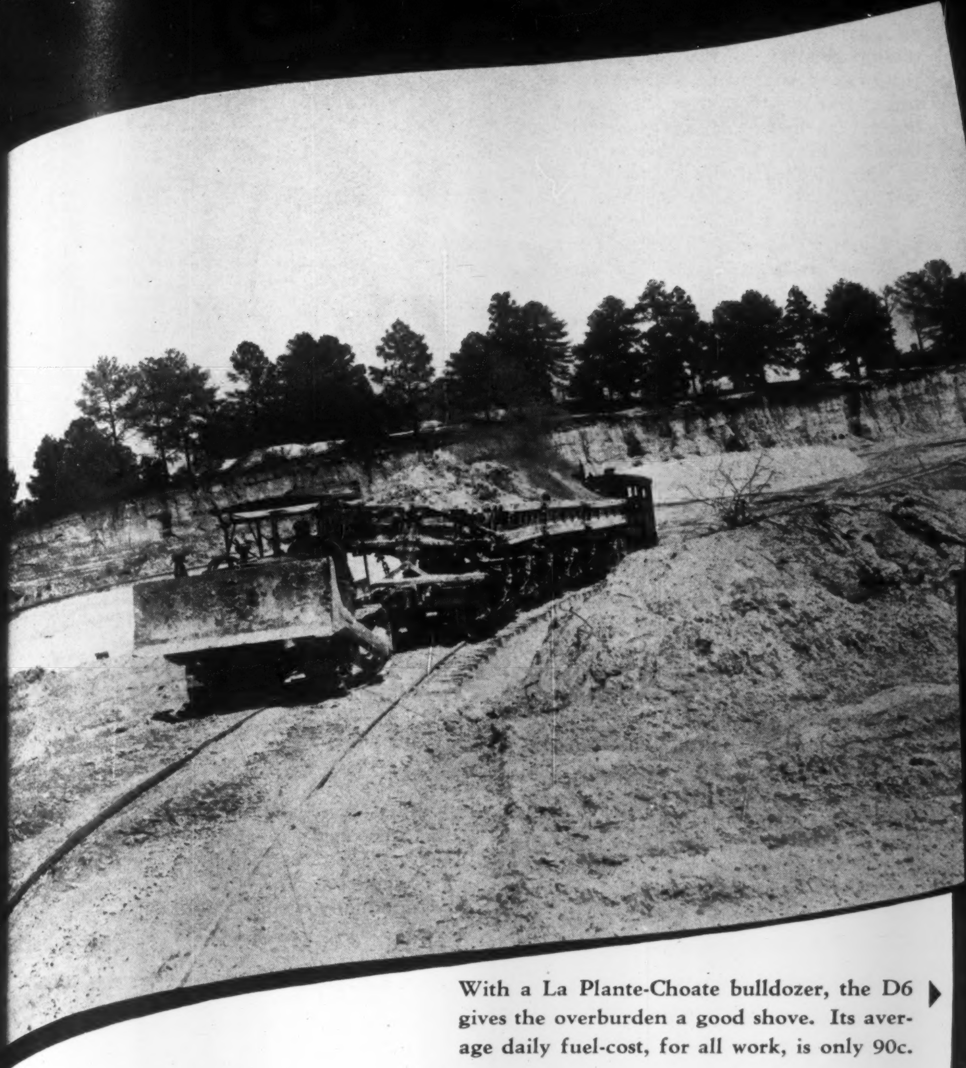

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Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

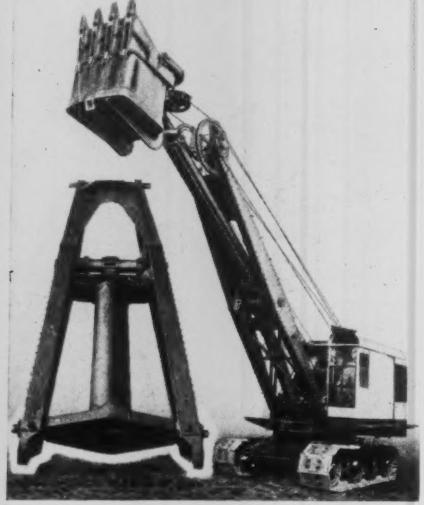
Ebony Finish Monel

The International Nickel Company Inc., has produced "Ebonized" Monel with an ebony finish designed for use where appearance must be maintained under temperatures up to 1,400° F. The material is identical with standard Monel except that a lustrous "blue-black" finish is imparted in a specialized oxidizing operation.

This new ebonized metal, like standard Monel, possesses complete rust immunity and diversified resistance to corrosion in addition to its new ability to resist discoloration from relatively high temperatures.

A New Development in Shovel Booms

A new shovel boom has been developed recently by the Thew Shovel Company for use on its $1^{1}/_{2}$ yd Lorain 77 and $1^{1}/_{4}$ yd Lorain 75-D.



The boom is virtually two booms in one—one, a structural member, absorbs all bending and compression stresses. The other, a torsional member, absorbs and resists all boom twisting stresses. Each member is connected independently to the shipper shaft and boom hinges in such a manner that no torsional stresses can pass through the structural member and no bending stresses can be transmitted to or through the torsion member.

The structural side members of the boom are fabricated of plates and alloy steel angles riveted and electric welded together into a plate girder construction. These members, which are fish belly in shape with the deepest and strongest section being at the center at the point of maximum stress, act as a beam and absorb all boom bending and compression stresses.

The separate torsional member is a seamless tube, about 11 in. in diameter, fastened to the shipper shaft by means of a cast steel U-shaped yoke. The yoke absorbs the shipper shaft torsional stresses and transmits them into the tubular torsion member, which transmits them to the base of the boom where they are, in turn, transmitted into the boom foot hinges by means of a cast steel crosshead. The torsion member is connected to the yoke and crosshead by electric welding.

The advantages of the cylindrical section are also made use of in the dipper stick of the new boom. Dipper sticks used in these booms are seamless tubes about 11 in. in diameter. A drop forge steel crowding rack and all other necessary adjuncts to the dipper stick are electric welded to the seamless tubing so that it is free of all rivet and bolt holes. The dipper stick operates in a huge barrel-shaped guide which is mounted on the shipper shaft and which is cylindrical in cross-section to fit around the dipper stick. It has a rectangular recess at the bottom in which the crowding rack slides, thus forming as a key and keyway to prevent the stick from twisting. The guide is lined, at either end, with cast iron wearing blocks which can be easily shimmed up or replaced to maintain the proper clearances for the cylindrical dipper stick.

In developing this boom, Thew has retained all the features of its center drive boom in which the shipper shaft is placed further ahead to give greater reaches and is located lower to permit the dipper stick to assume a more vertical angle for higher digging and dumping ranges.

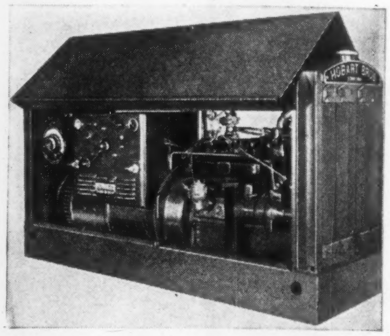
Highway Maintenance Truck

The Model HG, designed especially for highway maintenance work, has just been announced by the Four Wheel Drive Auto Company of Clintonville, Wis.

Among the features of the new maintainer unit is the construction of the patented transfer case for this particular model. The case has been built so that a clearance of 23 in. under the driving mechanism permits the installation of an underbody scraper, or other underbody maintenance equipment. Speed in high gear, with engine governed at 2,500 rpm, and standard tires as equipment, can reach 37.4 miles per hour, according to FWD engineers. Five speeds forward, and one reverse, and a transmission of selective sliding gear type are other features. The unit has a rated capacity of two tons, and a gross rating of 16,000 lbs. The chassis weight is 6,530 lbs with cab included. A wheelbase of 156 in. is standard. The six-cylinder FWD 6-MK motor develops 85 hp at 2,500 rpm, and has a torque of 256 lbs ft.

Small Arc Welder

A "Junior Model" 200 ampere gasoline-engine driven arc welder is announced by the Hobart Brothers Co., Troy, Ohio, to meet the demand for a unit of smaller size and lighter weight than existing models.



It is a completely equipped, factory-built outfit on sturdy steel skids, with complete canopy enclosure with hinged side panels that fold up over the top and can be padlocked when closed. Equipment includes electric self-starter, battery ignition with generator, air and fuel filters, variable speed governor, built-in fuel tank, and other engine equipment as furnished with larger machines.

The welding generator is provided with Hobart's remote control, polarity switch, built-in exciter, dual control, and other features exactly the same as in larger outfits. (Meters are optional equipment on this model.) The outfit is reported to be exceptionally economical to operate.

Duplex Power Pumps

Fairbanks, Morse & Co. has developed a new line of duplex power pumps for oil field service, fire protection and general service requiring pressures up to 800 lbs per sq in. and capacities to 187 gal per min.

Among the features of this new F-M Fig. 6130 power pump are quiet, efficient herringbone gears that insure a smooth flow of power to the fluid end, generous crank-shaft and pinion-shaft roller bearings that reduce mechanical friction to a minimum, and an improved line type fluid end. In handling heavy or viscous liquids, the speed of the power pump can be reduced.

F-M Fig. 6130 power pumps are offered with a fluid end piston stroke of 10 in. and with cylinder diameters of $1^{1}/_{2}$ to 5 in., providing a capacity range of 40 to 187 U. S. gal per min. at pressures from 250 to 800 lbs per sq in. The pumps can be furnished alone, with pulley for belt drive, or with top-mounted F-M motor and silent chain drive. Bulletin 6130 will be forwarded upon request to Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

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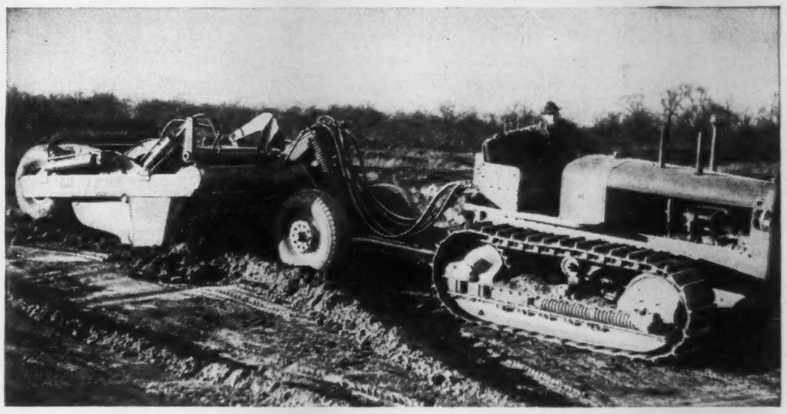
• *"Unit 61¼" shovel with Nickel-chromium-steel (SAE 3140) gears, and (SAE 3240) shafting, manufactured by Universal Power Shovel Corporation, Milwaukee, Wisconsin.*



• *Hydraulic road scraper manufactured by Gar Wood Industries, Inc., Detroit, Michigan. By using "Yoloy" Nickel-copper-steel produced by the Youngstown Sheet and Tube Co., Youngstown, Ohio, weight was cut from 18,500 to 13,500 lbs.*

...less wasted in moving dead weight

Build rugged strength into heavy duty equipment. At the same time, reduce useless weight—both accomplished when you employ the Nickel alloy steels. These two examples show how it is done in the case of two leading manufacturers of construction equipment:

1. Universal Power Shovel Corporation of Milwaukee, who use Nickel-chromium steels for the "Unit" shovel shown above, report as follows:

"We use Nickel alloy steels extensively throughout our machine because they provide uniformly high properties and are easy to heat treat without serious distortion. They are tough and dependable and have a high fatigue limit. This last feature is especially important in many of the shafts in power shovels, since they are constantly subjected to reversing loads."

2. When the Gar Wood hydraulic road scraper illustrated was re-designed, "Yoloy" Nickel-copper-steel was adopted. Result: weight reduced 5,000 lbs.—or an equivalent increase in payload of 20%.

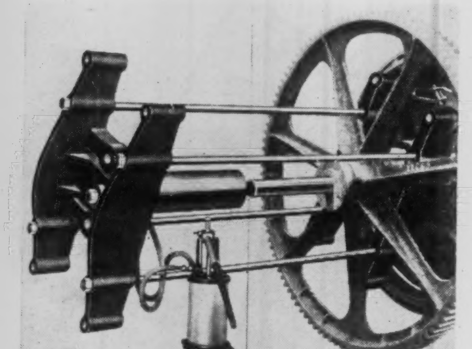
Where toughness and dependability are essential, and where breakage or failure of vital parts would cause expensive operating delays, employ the Nickel alloy steels. Consultation on their use is invited.

NICKEL ALLOY STEELS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Beco Portable Hydraulic Press

A NEW PORTABLE hydraulic press which can be used either as a puller, press, or jack (of capacity to 150 tons) is described in bulletin S-115 by the Bucyrus-Erie Company, South Milwaukee, Wis. The Beco Press is made expressly for use on heavy machinery to press large gears on shafts, pull bevel pinions, pull drum shaft gears, for press work on shovel gears, spiders, sprockets, swing shaft assembly, crowd shaft assembly, shipper shaft, and track mechanism. As a jack the compact press cylinder (ram) weighing only 75 lbs is used to lift and can be set up in any position.



The Beco Portable Press includes a frame for press work weighing 310 lbs, a 4-speed pump weighing 75 lbs, a press cylinder or ram weighing 75 lbs and having a pressure capacity up to 150 tons, four alloy steel frame rods, a back plate, and high-pressure hose and valve connections. Special equipment available includes sprocket lugs, frame extension rods, connectors for extension rods, extra long high-pressure hose, angle iron stand for frame, and frame for track repair work.

New Conveyor Belting Features Cord Construction

THE B. F. GOODRICH COMPANY, Akron, Ohio, has announced a radically new conveyor belting featuring cord construction which is said to give considerably longer wear than belts of the fabric-carcass type.

In contrast to the conventional conveyor belt design of building a carcass out of plies of woven fabric, Goodrich engineers have developed a construction which substitutes plies of weftless cords such as are used in the modern heavy-duty truck tire. These cords have no transverse or filler threads obstructing their freedom of movement. The result is a belt carcass in which every tension member is completely surrounded and insulated with rubber to increase its ability to absorb and withstand shock.

Goodrich Cord Conveyor Belting possesses extreme transverse and longitudinal flexibility. Cord construction also makes for a belt having great resistance to moisture and acid penetration. Goodrich Cord Belting is available in any length, width, and number of plies.

New Diesel Battery Line Announced by Goodrich

A COMPLETE LINE of specially constructed batteries for Diesel starting service is announced by The B. F. Goodrich Company, Akron, Ohio. In the line are four 6-volt types, two 8-volt types, and ten 12-volt types. Eight of the batteries are of conventional construction and eight built with the Kathanode construction. Port Orford Cedar separators, the highest type wood known for this purpose, are used in the separators of the conventional type. In the Kathanode type flexible spun glass Kathanode retainer mats are used on both sides of the positive plates, holding the active materials adjacent to them for a longer period, and thus increasing battery life.

The new line of Diesel batteries, according to the manufacturer, are built with thinner plates than heavy duty types, giving instant reaction and quick motor turnover. Adequate power is available instantaneously to ignite the fuel oil and start the motor in coldest weather. All batteries, except the 8-volt types, are assembled in hard rubber cases. The 8-volt types are assembled in hard rubber jars and wood cases. Connectors are of solid lead, except the 8-volt types, which are of flexible copper with lead coating to prevent corrosion. Cell covers are made of reinforced hard rubber, terminal posts are of the braced type, with rubber gasket seals and locknuts to prevent acid seepage, allowing for vibration of plates without causing damage. Splash proof vents are used and ample sediment space provided to prevent battery failure as a result of short circuits arising from an accumulation of sediment touching the plates.

Four-Cylinder Diesel Series

AS A FURTHER step in its line of high-speed Diesel engines, Hercules Motors Corporation has announced the series "DOO" four-cylinder Diesels.

Of neat, compact design, the new "DOO" series has been developed particularly for use in commercial vehicles of smaller and more popular sizes as well as for a wide variety of industrial, oil field, and marine applications. Three models of the new series have been produced. The smallest, the "DOOB" has a bore of $3^3/_4$ in. and a stroke of $4^1/_2$ in. with the total piston displacement of 198.8 cu in. The "DOOC" has a bore of 4 in. and a $4^1/_2$ in. stroke with 226.2 cu in. displacement and the "DOOD" has a $4^1/_4$ in bore and $4^1/_2$ in stroke with a 255 cu in. displacement. The "DOOB" is rated at 62 hp and the "DOOC" at 70 hp at an engine speed of 2,600 rpm. At 1,600 rpm the "DOOD" develops 56.5 hp.

Engines of the new series are interchangeable from an installation standpoint with the Hercules "OO" series of gasoline engines, allowing manufacturers to supply either gasoline or Diesel engines in their equipment without any mounting complications. This follows Hercules' practice in the three larger series of Diesel engines and companion gasoline models.

Folders Announced

CHLORINATORS—Bulletin No. "RED" on Chemical Feeding, just issued by Proportioneers, Inc., 9 Codding St., Providence, R.I., supplies many photographs and blueprints of a line of equipment suitable for practically any chemical solution or controlled dry feeding job.

CONCRETE BUCKETS—Catalog 1586, a 16-page, illustrated descriptive booklet, contains details, specifications and illustrations of various kinds of roller gate concrete buckets including cableway operating types, underwater types, and special designs for unusual requirements. Blaw-Knox Co., Pittsburgh, Pa.

DIESEL POWER UNITS—An attractive booklet tells in pictures and brief captions the many industrial uses of Caterpillar Diesel power units and tractors. Caterpillar Tractor Co., Peoria, Ill.

HIGHWAY DRAINAGE—A lengthy treatise on "Roadbed Stabilization by Drainage," presented before the convention of the American Road Builders' Association, has been published in booklet form by the Armco Culvert Manufacturers Association, Middletown, Ohio.

MACHINING ALUMINUM—is the title of a completely revised edition of the booklet containing detailed data on the maching of this metal and its alloys. Aluminum Co., Pittsburgh, Pa.

MOTORS—Fairbanks-Morse vertical hollow and solid shaft polyphase, ball-bearing, squirrel-cage, induction motors are described in bulletin 1410. Although these motors were developed primarily for direct-connection to vertical-shaft turbine, propeller and centrifugal type pumps, they have found wide application on special machine tools and various other industrial equipment. Fairbanks, Morse & Company, 900 South Wabash Ave., Chicago, Ill.

NICKEL ALLOYS—A catalog of catalogs has been prepared, to give a complete list of current literature available on the production and the industrial applications of nickel alloy steels, nickel cast irons, and nickel alloyed non-ferrous castings. Each publication listed is briefly described International Nickel Co., Inc., 67 Wall St., New York, N.Y.

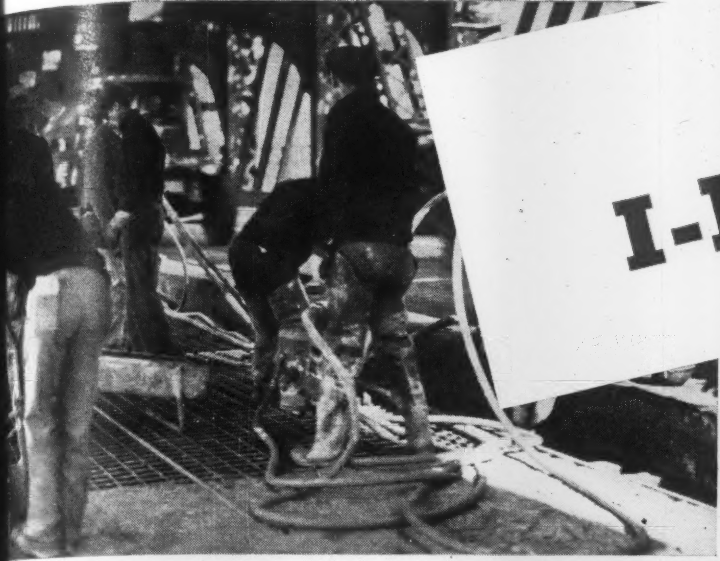
NICKEL ALLOY STEELS—The advantages of these alloys in hand and small power tools is outlined in a 16-page bulletin, U-3. International Nickel Co., Inc., 67 Wall St., New York, N.Y.

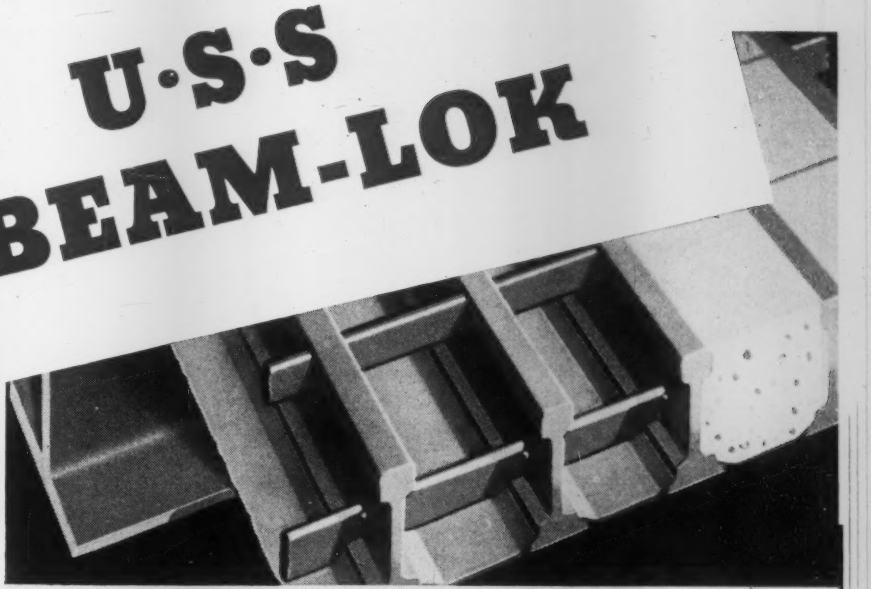
POLARIZED LIGHT—An interesting 16-page booklet, "Polaroid and Polarized Light," explains the polarization of light; the natural sources of polarized light, Polaroid; its characteristics and its scientific and general application. Polarizing Instrument Co., 8 West 40th St., New York, N.Y.

TANKS—A. M. Byers Company, Pittsburgh, Pa., have just had printed a useful 24-page bulletin, "Wrought Iron in Tank Construction," telling of the increasing use of tanks of this type in the petroleum industry, and in the industrial, railroad, marine, and building fields.

modernized with . . .

U·S·S I-BEAM-LOK





CONCRETE POURING

From truck mixers, concrete in 4½ yd. batches was chuted to place, spread by hand shoveling, thoroughly rodded to fill the spaces in the I-Beam-Lok units. A vibrating screed was then dragged along the concrete surface to insure complete and thorough settlement. Notice in picture at left—how heavy equipment can be run on the unfilled units as soon as they are placed in position.

U·S·S Armored I-BEAM-LOK

U·S·S armored I-Beam-Lok consists of a spaced series of small I-Beams comprising the main structural elements, with the intervening spaces filled by concrete ribs. The beams and ribs are locked together into a rigid homogeneous slab by intersecting and interlocking steel top and bottom crossbars welded at regular intervals. The upper edges of the top crossbars are brought into the plane of the tops of the small I-Beams.

109,210 sq. ft. of lightweight Armored Flooring gives famous East River span a modern floor for modern traffic

ARMORED slabs of 3½″ I-Beam-Lok, weighing but 61.2 pounds per square foot, now floor the river spans of the Queensboro Bridge and produce a modern five-lane reinforced concrete roadway that completely meets the demands of the world's heaviest traffic.

Here is a floor that is light in weight. Strong. Long-wearing. Free from progressive cracking. Fire-safe and anti-skid. A floor that minimizes traffic-tangling road repairs. That once and for all banishes the skidding hazards that formerly made this drive over the East River a fender-bending free-for-all in wet weather.

The requirements of this job were stringent. The roadway must safely carry an H-20 highway loading. It must resist the pound and grind of a terrific volume of both passenger and heavy commercial traffic—109,000 vehicles per 24 hours. Minimum weight, too, was a prime essential.

In view of these facts the selection of I-Beam-Lok in this important construction is highly significant. Its use on the Queensboro Bridge was determined by the results of a two-year test of a trial slab installed in old bridge floor, and its record of successful performance on 145 other bridges, large and small, both new and old, in which its obvious advantages have been amply demonstrated. The completion of this job brings the amount of I-Beam-Lok flooring that has been applied during the last three years up to more than 1,000,000 sq. ft.

If you want complete information on this modern bridge flooring or assistance in its application to your designs, get in touch with our engineers. They will be glad to discuss its possibilities and installation with you.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

June 1937, pp. 355–361. Brief report on construction of dams; aggregate and mixing plants; diversion tunnels; placing concrete. Before Instn. Civ. Engrs.

Concrete. Elements of Chickamauga Dam, L. G. Warren. *Eng. News-Rec.*, vol. 119, no. 17, Oct. 21, 1937, pp. 667–668. Features of Tennessee Valley Authority dam across the Tennessee River consisting of concrete spillway section, 111 ft maximum height, flanked by earth embankments totaling 4,280 ft in length; spillway section is 1,520 ft long; description of canal lock and 50,000-kw power plant.

Concrete, Tennessee. Bad Rock Limits TVA Dam Location. *Eng. News-Rec.*, vol. 119, no. 17, Oct. 21, 1937, pp. 665–666. Reasons for selection of site for Chickamauga Dam on Tennessee River where no satisfactory foundation rock can be found; controlling factors; methods of exploration.

Concrete Arch. Ruby Dam Unit of Skagit River Project Will Be Started at Once by Seattle, G. H. Smith. *Western Construction News*, vol. 12, no. 6, June 1937, pp. 218–220. Features of concrete arch dam, which will be second highest dam in world, being built on Skagit River 125 miles northeast of Seattle, Wash.; ultimate height 640 ft; use of model tests in design of dam.

Concrete Arch, Washington. Arch Dam 390 Ft High for Puyallup River Project. *West. Construction News*, vol. 12, no. 1, Jan. 1937, pp. 17–18. Features of proposed Mud Mountain concrete arch dam, 390 ft high, to be built across Puyallup River, near Buckley, Wash., at estimated cost of $3,206,000; Tacoma channel improvement to carry discharge of 50,000 cu ft per sec.

Concrete Gravity, Colorado River. Deep Excavation for Parker Dam. *Eng. News-Rec.*, vol. 119, no. 22, Nov. 25, 1937, pp. 853–856. Initial progress report on construction of concrete gravity dam having maximum height of 320 ft above lowest foundation, but only 85 ft above stream-bed; construction of cofferdams and prevention of troublesome seepage; present status of construction.

Concrete Gravity, Construction. Seminoe Dam Progress, J. H. Warner. *Eng. News-Rec.*, vol. 119, no. 21, Nov. 18, 1937, pp. 817–822. Progress report on construction of concrete gravity dam in North Platte River in Wyoming; description of construction camp, tunnel, and rock cut work; spillway inlet cut, extension trestle, stripping, and abutments; tail-race excavation difficulties; construction plant; progress schedule.

Earth, Design. Instructions for Design and Construction of Small Dams, L. C. Tschudy and J. G. Sutton. *Pub. Works*, vol. 68, no. 7, July 1937, pp. 16–18. Instructions covering design and construction of dams suitable for Civilian Conservation Corps work in North Dakota not exceeding following average heights above stream beds; earth dams, 20 ft; rubble masonry dams, 10 ft; timber crib dams, 8 ft; protection for earth dams; core wall and sheet piling.

Foundations. Parker Dam Foundation Excavation Sets Record Depth of 250 Ft. *West. Construction News*, vol. 12, no. 2, Feb. 1937, pp. 49–51. Equipment and methods used in excavation to rock of foundation of Parker Dam on Colorado River, near Parker, Ariz., to depth of 250 ft below river bed.

Masonry. Design of Masonry Gravity Dams, G. B. Williams. *Instn. Engrs. India—J.*, vol. 17, Aug. 1937, pp. 113–151, (discussion) 152–162. It seems that it should be practicable to design standard profiles that, with comparatively slight modifications, could be adapted to conditions which any ordinary masonry dam has to meet; writer shows that such profiles can be devised, and explains method by which their proportions can be determined.

Multiple Arch, Arizona. Highest Multiple Arch Dam Under Construction on Verde River in Arizona. *Western Construction News*, vol. 12, no. 6, June 1937, pp. 204–207. Layout and procedure for construction of multiple-arch dam, 270 ft maximum height, total length 800 ft, being built on Verde River, 54 miles from Phoenix, Ariz., for U. S. Bureau of Reclamation; materials handling; opening up site; river diversion; concrete placing.

Reservoirs, Waterproofing. Pond Bottoms Sealed by Bentonite, C. C. Davis. *Eng. News-Rec.*, vol. 119, no. 18, Oct. 28, 1937, p. 725. Waterproofing of ponds, occupying area of 2.1 acres, at Norris fish hatchery, Knoxville, Tenn., by spreading bentonite on plowed-up bottom.

Rock Fill, Algeria. Algerian Dams of Placed Rock Fill, I. Gutmann. *Eng. News-Rec.*, vol. 119, no. 23, Dec. 2, 1937, pp. 889–894 (editorial comment, p. 886). Review of new laid-fill practice developed in recent construction for Algerian rock-fill dams, varying in height from 76 ft to 410 ft; placing of laid rubble; design and construction of impervious two-course concrete deck and jointless asphalt deck; design of spillways.

Stilling Basins. New Type Energy Diffuser for Hydraulic Structures. *Western Construction News*, vol. 12, no. 6, June 1937, p. 235. Design of velocity reducer for spillway discharge featuring bucket extended to horizontal position to produce roller action; this device in operation at Wheeler Dam has proved able to decrease velocity at toe of spillway approximately 6 per cent.

FLOOD CONTROL

California. Engineering and Design for Los Angeles Flood Control, R. E. Cruse. *Military Engr.*, vol. 29, no. 166, July-Aug., 1937, pp. 282–287. Survey and hydrological study of Los Angeles district; hydraulic design and construction planning of flood control system; structural design; description of laboratory.

Discharge. Flood Runoff from Small Areas, V. H. Cochrane. *Eng. News-Rec.*, vol. 119, no. 22, Nov. 25, 1937, pp. 864–867. Theoretical study of rainfall and runoff rates leading to derivation of original formulas for flood runoff; comparison of author's original formula with formulas proposed by Jarvis, Gutmann, Fuller, and others.

Illinois. Magnitude and Frequency of Floods on Illinois Streams, G. W. Pickels. *Univ. Ill.—Eng. Experiment Station—Bul.*, no. 296, vol. 34, no. 103, Aug. 24, 1937, 59 pp. Probability analysis of magnitude and frequency of floods on Illinois streams, including detailed analysis of flood-flow data on twenty-four Illinois streams.

Mississippi River. High Water in Lower Mississippi, R. G. Moses. *Military Engr.*, vol. 29, no. 165, May-June, 1937, pp. 163–168. Review of Mississippi flood control work done under Flood Control Act of 1928; description of flood of January and February 1937; preparations for high-water fight; conditions at Cairo; passage of crest; work in New Orleans district; comparison of 1929 and 1937 floods on Mississippi River.

Ohio. Flood and Fires at Cincinnati, C. M. Stegner. *Bldg. Standards Monthly*, vol. 6, no. 8, Aug. 1937, pp. 4–6, and 15–16. Report on stored gasoline fires and damage to water system caused by record flood of January 1937 in Cincinnati, Ohio; oil storage in flood area; rehabilitation program.

Sanitation. Sanitation Conditions in Flood Areas, J. K. Hoskins. *Am. Water Works Assn.—J.*, vol. 29, no. 9, Sept. 1937, pp. 1298–1307. Some effects of flood; provision of emergency sanitation measures; collaboration with other governmental agencies; some emergency sanitation problems; public water supplies.

United States. Floods of March 1936, Part I. New England Rivers, N. C. Grover. *U. S. Geol. Survey—Water-Supply Paper*, 798, 1937, 466 pp., 70 cents. General features of storms; meteorologic and hydrologic conditions; precipitation records; snow; temperature; frost in ground; determination of flood discharges; stages and discharges at river-measurement stations during flood period.

Water Works, Damage. Water Works Lessons from 1937 Ohio River Flood, L. R. Howson. *Am. Water Works Assn.—J.*, vol. 29, no. 9, Sept. 1937, pp. 1288–1297. Magnitude of flood; losses and hazards; general conclusions.

FOUNDATIONS

Caissons. Sinking Caissons in Debris Fill. *Eng. News-Rec.*, vol. 119, no. 19, Nov. 4, 1937, pp. 743–748. Method of sinking 353 caissons and 143 sheeted pits through filled shoreline of various bulkheads, dumped rock, and debris, for construction of express highways along Hudson River waterfront in New York City; use of shells with toothed-edged bottom rotated bodily like drill; heavy pumping in sheeted pits; open sinking in harbor mud; withdrawal of shells by use of jacks; contract prices of caisson and pier work.

Cofferdams, Removal. Removing a Collapsed Cofferdam, E. P. Ketchum. *Military Engr.*, vol. 29, no. 165, May-June, 1937, pp. 203–205, (discussion) 206. Operations for removal of large cofferdam in constructing main and auxiliary locks No. 26 on Mississippi River at Alton, Ill.; recovery operations.

Landslides, California. Hillside Lets Go in Los Angeles. *Eng. News-Rec.*, vol. 119, no. 23, Dec. 2, 1937, p. 881. Brief report on slide of 6-acre cliff face in Elysian Park, Los Angeles, which destroyed concrete viaduct approach to Dayton Avenue Bridge and blocked Riverside Drive for distance of 350 ft; possible causes of slide.

Retaining Walls, Design. Low Retaining Walls, C. N. Dirlam. *Bldg. Standards Monthly*, vol. 6, no. 7, July 1937, pp. 4–7. Discussion of failures of low retaining walls and rules for their safe design.

HYDRAULIC ENGINEERING

Flow of Water, Bends. Flow of Water Around 180-Degree Bends, D. L. Yarnell and S. M. Woodward. *U. S. Dept. Agriculture—Tech. Bul.*, no. 526, Oct. 1936, 64 pp., figs., tables, diagrs., 10 cents. Experimental study by Bureau of Agricultural Engineering in cooperation with University of Iowa College of Engineering on effects of 180-deg bends of square and rectangular cross-section on flow of water, including cases with uniform and non-uniform velocity distribution in channel approaching bend; laws governing changes in pressure and velocity.

Flow of Water, Measurement. Flow of Water Over Masonry Weirs and Notches, M. L. Garga. *Instn. Engrs., India—J.*, vol. 17, Aug. 1937, pp. 201–239, (discussion) 240–251, supp. plates. Author's experience in calibrating certain falls and discharge sites being used as controlling points, after completion of Sarda Canal construction.

Hydraulic Jump. Standing Wave Problems, T. Blench. *Engineer*, vol. 164, nos. 4256, 4257, and 4258, Aug. 6, 1937, pp. 145–147; Aug. 13, pp. 172–174; and Aug. 20, pp. 197–199. Problems discussed are (1) position of standing wave on gently sloping weir glacis and (2) design of fall so that standing wave shall not move off glacis on to channel bed; graphic presentation of Bernouilli's equation and hydraulic jump equation with applications; old and new standing wave problems, with various solutions based on conventional jump theory; more rigid treatment of jump theory.

INLAND WATERWAYS

Rivers, Improvement. Remodeling Channels and Sluices in Cauvery Delta, K. P. Pillai. *Instn. Engrs., India—J.*, vol. 17, Aug. 1937, pp. 69–105, (discussion) 106–112. Paper describes field operations and calculations made; non-deltaic irrigation of river; description of delta and its irrigation; silting up of rivers and channels; remodeling sluices.

Rivers, Revetments. Asphaltic Paving Used on Flood Control Revetments, W. E. Christison. *Western Construction News*, vol. 12, no. 6, June 1937, pp. 224–225. Experimental work by Los Angeles County, California, undertaken to develop surfacing with characteristics of low first cost, flexibility, long life, and small maintenance; preliminary conclusions are favorable.

PORTS AND MARITIME STRUCTURES

Jetties. Asphalt Used in Experiment to Consolidate Columbia River Jetty, G. E. Bjorik. *West. Construction News*, vol. 12, no. 3, March 1937, pp. 89–92. Use of asphalt admixture for filling voids to prevent disintegration and ravelling of rock at sea end of south jetty at mouth of Columbia River; characteristics of asphaltic mix used; mixing plant arrangement; major items of equipment; cost data.

Piers, Maintenance and Repair. Method of Reconditioning 20-Year Old Pier with Gunite, E. A. Hoffman. *West. Construction News*, vol. 12, no. 3, Mar. 1937, pp. 104–105. Method of repairing substructure of Richmond Municipal Wharf No. 1, at Richmond, Calif., involving reconditioning of concrete piles, beams, and floor slab; material specifications; methods of construction; waterproofing.

Portland, Me. Port of Portland, Maine U. S. Army Corps of Engrs.—Port Series, No. 1 1937, 125 pp., supp. maps. 25 cents. Revision of data published in 1928; information showing movement of commerce through port, facilities available for handling traffic, also rates and charges applying against it.

Shore Protection, Great Britain. Sea Defence at Hythe. *Civ. Eng.* (*London*), vol. 32, no. 372, June 1937, pp. 215–218. Description of new shore-protection works and repair of old work, Hythe, England; continuous reinforcement; prevention of drift.

Wood Preservation. Report of Committee XVII—Wood Preservation. *Am. Ry. Eng. Assn.—Proc.*, vol. 38, 1937, pp. 309–353, (discussion) 735–736, 1 supp. sheet. Service-test records for treated ties; piling used for marine construction; destruction by termites and possible ways of prevention; outline of complete field of work of committee.

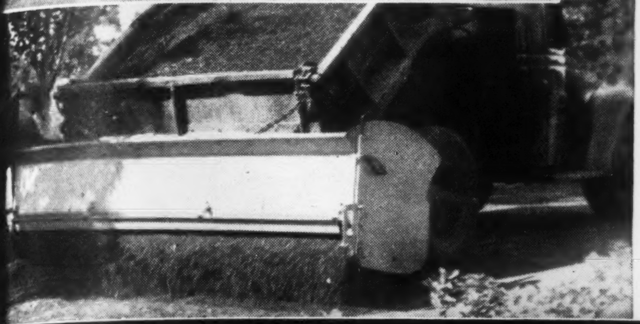
ROADS AND STREETS

Africa. Roads in Nyasaland, B. R. Peters. *Roads & Road Construction*, vol. 15, no. 174, June 1, 1937, pp. 177–179. Review of construction and maintenance practice; cost data.

Bituminous. Montana Uses Cutback Asphalts in Bituminous Highway Surfacing, D. L. Cheney. *Western Construction News*, vol. 12, no. 4, April 1937, pp. 127–129. Performance of extensive test sections of plant-mix and road-mix mat, built in 1935, resulting in tentative conclusion that this binder is better adapted to Montana than asphaltic road-oils; tack coat problem; grading of aggregate; road mix projects.

Concrete. Construction Design Chart—XIV—Concrete Road Slabs, J. R. Griffith. *West. Construction News*, vol. 12, no. 2, Feb. 1937, p. 79. Formulas and alignment chart for computing thickness of concrete road slabs.

Concrete. Trends in Design and Construction of Concrete Pavements, H. J. Gilkey. *Concrete*, vol. 45, no. 4, Apr. 1937, pp. 7–10. Author believes that problems needing further attention include shoulders and drainage, better joints and



Here's how St. Paul PROTECTS ITS INVESTMENT IN PAVEMENTS *with*

STANOLIND CUT-BACK ASPHALT

● St. Paul, like many other cities in the middle west, has found that it is cheaper to protect its pavements by surface treating than it is to pay the high repair bills and repaving costs that inevitably follow where pavement surfaces are neglected.

Surface treatment with Stanolind Cut-Back Asphalt, as described here, is a simple, inexpensive method of restoring the wearing surface of asphalt or asphaltic concrete streets that has been worn by traffic. It provides a smooth riding, non-skid surface. It protects your original investment in the street, assuring the long life that properly maintained asphalt paving will give.

Let a Standard Asphalt representative describe this method fully to you. He can give you specifications and figures on this and all types of asphalt paving. Call him at your local Standard Oil (Indiana) office or write: 910 South Michigan Avenue, Chicago, Ill.

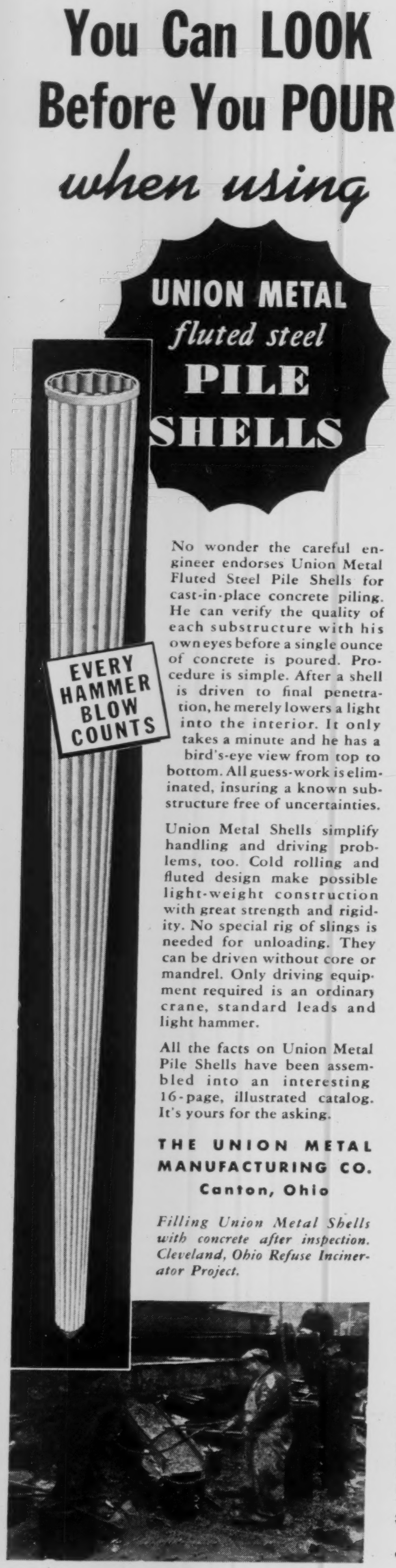
The four steps illustrated here describe the surface treatment of sheet asphalt streets in St. Paul, Minnesota.

1. Applying prime coat.
2. Spreading rock for wearing course.
3. Mixing on the street.
4. Rolling.
5. The finished street. In this instance 65 pounds of aggregate and ¾-gallon of Stanolind Cut-Back Asphalt per square yard were used in two applications.

Copr. 1938, Standard Oil Co.

Asphalt for every purpose

STANDARD OIL COMPANY
(INDIANA)



No wonder the careful engineer endorses Union Metal Fluted Steel Pile Shells for cast-in-place concrete piling. He can verify the quality of each substructure with his own eyes before a single ounce of concrete is poured. Procedure is simple. After a shell is driven to final penetration, he merely lowers a light into the interior. It only takes a minute and he has a bird's-eye view from top to bottom. All guess-work is eliminated, insuring a known substructure free of uncertainties.

Union Metal Shells simplify handling and driving problems, too. Cold rolling and fluted design make possible light-weight construction with great strength and rigidity. No special rig of slings is needed for unloading. They can be driven without core or mandrel. Only driving equipment required is an ordinary crane, standard leads and light hammer.

All the facts on Union Metal Pile Shells have been assembled into an interesting 16-page, illustrated catalog. It's yours for the asking.

THE UNION METAL MANUFACTURING CO.
Canton, Ohio

Filling Union Metal Shells with concrete after inspection. Cleveland, Ohio Refuse Incinerator Project.

doweling, better control of construction operations.

Concrete, France. New Tendencies in Concrete Road Construction. R. Quennessen. *Roads & Road Construction*, vol. 15, no. 174, June 1, 1937, pp. 165–167. Review of recent practice developed in France; composition of concrete roads; placing and finishing; density of concrete slabs.

Construction. Highway Fills Stabilized on Marshes by Means of Vertical Sand Drains, O. J. Porter. *West. Construction News*, vol. 12, no. 2, Feb. 1937, pp. 58–61. Use of vertical sand drains to accelerate rate of consolidation in soft subgrade materials under highway fills of California Division of Highways; construction methods for highway fills on soft or marshy ground which would result in maximum roadway stability at minimum cost; slipouts in highway fills; drains tested in laboratory; sand drains in field.

Culverts, Construction. Long Culvert Built by Jacking, J. Scotzin. *Eng. News-Rec.*, vol. 119, no. 23, Dec. 2, 1937, pp. 904–905. Working procedure in jacking 3-ft pipe culvert 210 ft through 66-ft fill, recently completed by engineers of Pennsylvania Department of Highways; comment on practice; cost data.

Highway Systems, California. Scenic Road Traverses California Sierras. *Eng. News-Rec.*, vol. 119, no. 22, Nov. 25, 1937, p. 863. Current development of high-altitude recreational highway 780 miles long, along Sierra Nevada, from separate road-building projects largely in national forests.

Highway Systems, Michigan. Roads Grow to Superhighways, L. C. Smith. *Eng. News-Rec.*, vol. 119, no. 22, Nov. 25, 1937, pp. 857–860. Extension and improvements of highways of Wayne County, Mich., up to paved widths of 90 ft and dual roads 204 ft wide; master plan of superhighways; mileages of these roads; Woodward superhighway.

Materials, Bituminous. Laboratory Researches on Bituminous Mortars, J. Z. Zaleski. *Roads & Road Construction*, vol. 15, no. 170, Feb. 1, 1937, pp. 36–39. Review of apparatus and methods developed at Chemical Research Institute of Warsaw, Poland, for testing of bituminous mortars used in road construction; effect of molding pressure and height of briquet; effect of percentage of bitumen; effect of grain size in mineral aggregate; effect of mixing temperature; effect of time of mixing; effect of type of bitumen.

Parks. Road Construction in Yellowstone Park, J. A. Lunsford. *Military Engr.*, vol. 29, no. 167, September-October 1937, pp. 343–346. Early history of park; initiation of road work; subdrainage and subgrade stabilization; landscaping and bridges.

Railroad Construction, Specifications. Report of Committee I—Roadway. *Am. Ry. Eng. Assn.—Proc.*, vol. 38, 1937, pp. 163–181, (discussion) 614–621. Reports on physical properties of earth materials; specifications for cast-iron culvert pipe; roadway drainage and protection; signs, particularly roadway signs required.

Railroad Crossings. Report of Committee IX—Highways. *Am. Ry. Eng. Assn.—Proc.*, vol. 38, 1937, pp. 255–272, (discussion) 634–635. Revision of manual; highway-railroad grade crossing signs; design and specifications for highway crossings at grade over railway tracks, both steam and electric; "gates-not-working" and "watchman-not-on-duty" signs; barrier type of grade crossing protection, including automatic gates; outline of complete field of work of committee.

Railroad Crossings, Gates. Automatic Gates on Rock Island. *Ry. Signaling*, vol. 30, no. 11, Nov. 1937, pp. 640–644. Chicago, Rock Island & Pacific Railroad has recently completed substitution, for manually operated gates, of flashing light units, bells, and automatic gates, all interconnected with street traffic signals, at 95th Street crossing with four-track main line in Chicago; track layout given; special circuits provided due to complicated layout; control of crossing device.

Railroad Crossings, Gates. Three Gate Crossings in Row. *Ry Signaling*, vol. 30, no. 12, Dec. 1937, pp. 706–707, and 709. Crossing gates, operated by semaphore mechanisms, installed by Chicago, Milwaukee, St. Paul and Pacific Railroad at three heavily traveled crossings in Edgebrook, Ill., on outskirts of Chicago, as supplementary protection to flashing lights, bells, and street lighting.

Railroad Signals and Signaling. Mechanical Plant Replaced by Single-Lever Interlocking. *Ry. Signaling*, vol. 30, no. 11, Nov. 1937, pp. 646–648. At Eaton, Colo., 60 miles north of Denver, Colo., Union Pacific Railroad has installed single lever, hand-operated ground stand, with electric lock for both positions, to control derails and signals at crossings, thus eliminating operating expense of regular interlocking.

SEWERAGE AND SEWAGE DISPOSAL

Activated Sludge. Adjustment of pH Value of Sewage by Means of Carbon Dioxide, T. Chujo. *Sewage Works J.*, vol. 9, no. 5, Sept. 1937, pp. 750–762. Design and operation of Kisshoin experimental activated sludge sewage-disposal plant at Kyoto, Japan; most of waste coming from dye plants; pH adjustment by sulfuric acid, by ferric chloride, carbon dioxide gas; effect of flue gas on pH of sewage.

Activated Sludge, Experiments. Notes on Operation of San Antonio Activated Sludge Plant, E. J. M. Berg. *Sewage Works J.*, vol. 9, no. 5, Sept. 1937, pp. 769–776. Results of experimental digestion studies at sewage-treatment plant of San Antonio, Tex.; installation of additional digesters; operation of activated-sludge plant. Before Texas Water Works Short School.

Biochemical Oxygen Demand. Comparison of Sewages of Ohio Municipalities on Basis of Oxygen Requirement per Capita per Day, B. M. McDill. *Sewage Works J.*, vol. 9, no. 5, Sept. 1937, pp. 763–768. Per capita oxygen requirement, in pounds per day, of Ohio municipal sewages computed on 5-day basis. Before Ohio Conference on Sewage Treatment.

Chemical Process, Arizona. Chemical Treatment of Sewage with Plant-Made Ferric Chloride, J. A. Carollo. *Western Construction News*, vol. 12, no. 6, June 1937, pp. 222–224. Description of chemical treatment sewage disposal plant of Glendale, Ariz., with creamery wastes forming one-third of its total flow; revamping of old Imhoff tanks for sludge digestion and gas collection; details of ferric chloride unit; continuous basins.

Chemical Process, Texas. Operating El Paso Chemical Treatment Plant, C. D. Yaffe. *Sewage Works J.*, vol. 9, no. 5, Sept. 1937, pp. 777–784. Review of operating results at chemical precipitation sewage-disposal plants of El Paso, Tex.; sewage flow and dilution ratios; description of plant; sludge digestion; chemical treatment with ferric chloride; comparison with other chemical plants. Before Texas Water Works Short School.

Europe. Observations on Sewage Treatment Abroad, W. Rudolfs. *Mun. Sanitation*, vol. 8, nos. 3 and 4, Mar. 1937, pp. 179–183, and Apr., pp. 221–224. March: Sewage disposal methods and experiments in England, Scotland, and Holland; aeration experiments at Davyhulme (Manchester); dry weather flow at Halifax; grease removal from dried sludge; use of coal filters. April: Observations on operation of sewage disposal plants in Great Britain and in Holland; bioaeration; bulking and settling; chemical treatment in Holland. (To be continued.)

Filters. Effect of Stirring of Sludge on Vacuum Filtration, C. E. Keefer and H. Kratz, Jr. *Sewage Works J.*, vol. 9, no. 5, Sept. 1937, pp. 743–749. Results of experimental studies by Bureau of Sewers of Baltimore, Md., showing that stirring of sludge before coagulation reduced rates of filtration; effect on filtration of stirring raw semi-digested and digested sludge before or after coagulation. Bibliography.

Pipe, Vitrified Clay, Failure. Collapse of 4-Ft Diameter Brick Sewer and Its Reconstruction, B. Bhattacharjee. *Instn. Engrs., India—J.*, vol. 17, Aug. 1937, pp. 163–183, (discussion) 184–200. Author's experience as associate in work of diverting flow from collapsed section and by-passing it in pipe siphon laid above ground; collapse occurred in Dacca in rainy season of 1934.

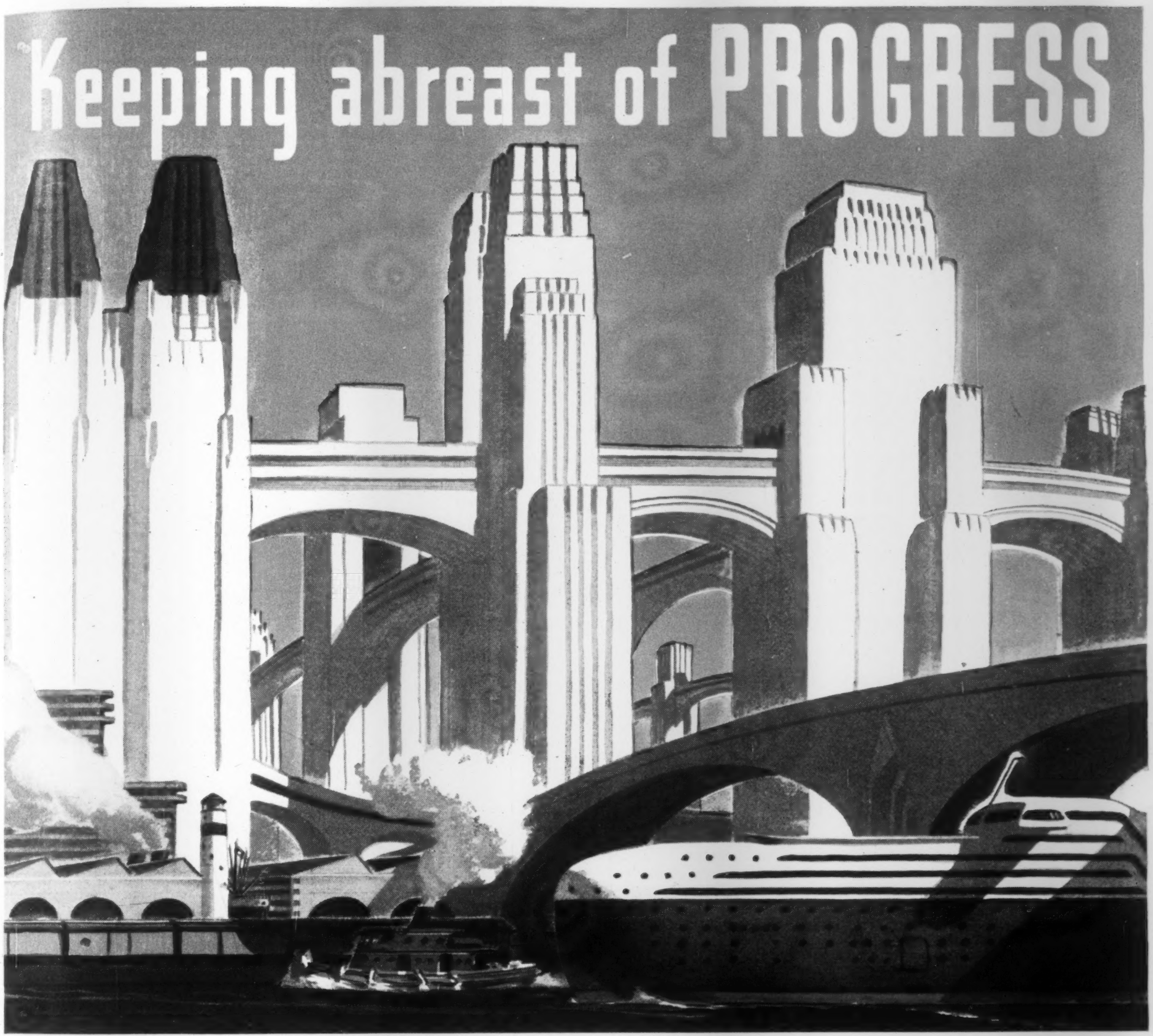
Plants, New Britain, Conn. New Britain Completes Plant of Guggenheim Type, F. G. Cunningham and H. K. Gatley. *Mun. Sanitation*, vol. 8, no. 4, Apr. 1937, pp. 214–220. Design and construction 18-mgd sewage treatment works of chemical precipitation type for New Britain, Conn.; process diagram; return sludge facilities; chemical facilities for sewage treatment; layout of machinery; sludge disposal facilities; rubber belt conveyors carrying dewatered sludge from vacuum filters; chemical storage.

Plants, Operation. Round Table for Discussion of Practical Sanitation Problems. *Mun. Sanitation*, vol. 8, no. 4, Apr. 1937, pp. 238 and 240. Practical discussion of methods of handling supernatant liquors at sewage treatment plants.

Plants, Waste Utilization. Sewage Sludge as Fertilizer. *Eng. News-Rec.*, vol. 119, no. 23, Dec. 2, 1937, pp. 906–907. Abstract of American Public Health Association Committee Report summarizing available data and concluding that sludge may have definite place in soil fertilization; fertilizing values; grease removal; dried activated sludge; hygienic considerations.

Sewers, Concrete. Pre-Cast Concrete Liners for Building Storm Drain, J. W. B. Blackman. *West. Construction News*, vol. 12, no. 2, Feb. 1937, pp. 55–56. Design based on maximum use of hand operating with minimum cost of forms for WPA projects, Long Beach, Calif.

Sewers, Construction. Trenching for Sewer Construction. *Pub. Works*, vol. 68, nos. 3 and 5, Mar. 1937, pp. 14–16, and May, pp. 11–13. Types of equipment used for trenching, including pavement breakers, portable air compressors, excavators, power-operated spades.



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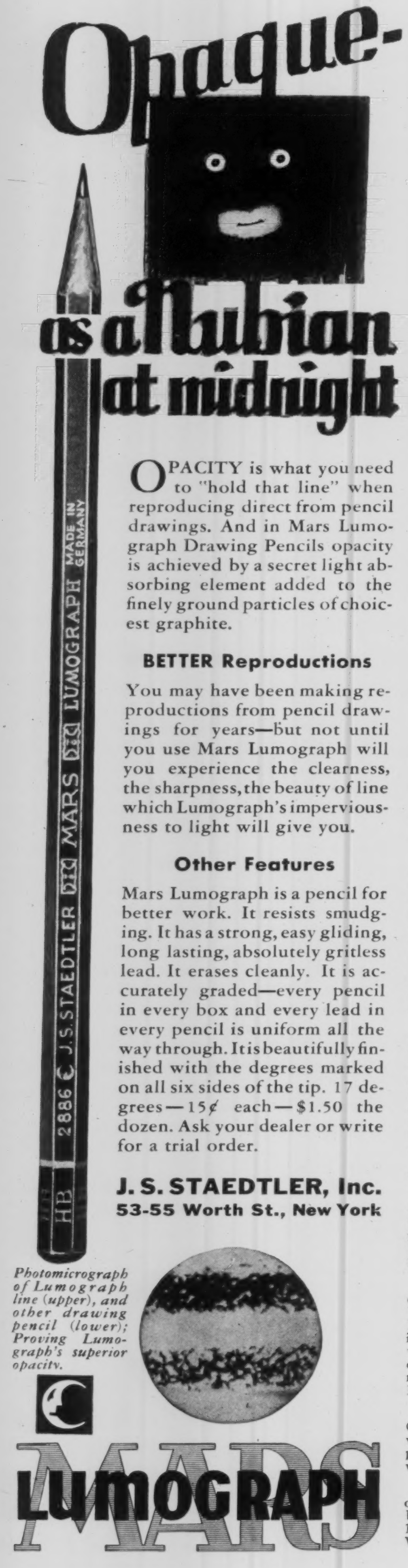

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STRUCTURAL ENGINEERING

BRICK CONSTRUCTION, REINFORCED. Grouted Reinforced Brick Masonry, C. H. Fork. *Bldg. Standards Monthly*, vol. 6, no. 8, Aug. 1937, pp. 7–11. Use of cement mortar and lime putty grout in construction of reinforced brick walls, 13 in. thick, for new Vermont Avenue School recently erected in Los Angeles, Calif.; details of construction and tests.

CHIMNEYS, CONCRETE. Selby Smelter Now Has World's Tallest Stack. *Eng. & Min. J.*, vol. 138, no. 10, Oct. 1937, pp. 34 and 44. Notes on construction of reinforced concrete chimney 605 ft 9 in. high from top of foundation slab to crown of shaft; field work was completed in about 244 days.

TRUSSES, BAMBOO. Experimental Bamboo Truss, G. Kumpe. *Military Engr.*, vol. 29, no. 166, July-Aug. 1937, pp. 288–289. Design and erection of bamboo trusses for bridge of 50-ft span developed by Company C, 14th Engineers, Philippine Scouts.

TUNNELS

AQUEDUCTS, COLORADO RIVER. Colorado River Aqueduct: Materials and Their Inspection, L. H. Tuthill. *Bldg. Standards Monthly*, vol. 6, no. 4, Apr. 1937, pp. 6–9, and 11–14. Summary of features of Colorado River aqueduct, particularly tunnel sections; specifications and inspection routine for cement, aggregates, concrete sealing compound, whitewash materials, coal tar enamel, and primer.

SPILLWAYS. Contractor Handles Tough Problems in Driving Horse Mesa Dam Spillway Tunnel. *West. Construction News*, vol. 12, no. 3, March 1937, pp. 94–97. Sheer cliff blasting near existing dam and powerhouse; restriction as to reservoir levels and other difficulties encountered in construction of tunnel spillway of large diameter; camp and plant; major units of equipment; lining program.

WATER SUPPLY, CHARLESTON, S.C. 18-Mile Unlined Tunnel Built Through Marl Formation, J. E. Gibson. *Water Works Eng.*, vol. 90, no. 10, May 12, 1937, pp. 568–571. Construction of low-cost aqueduct for Charleston, S.C., by driving 18-mile, 50-mgd tunnel through hard marl that had withstood water contact for 8 years; job equipment.

WATER SUPPLY, LINING. Full-Circle Forms Used for Lining Heavily Reinforced Pressure Tunnels. *West. Construction News*, vol. 12, no. 3, Mar. 1937, pp. 108–111. Placing concrete by guns in continuous pours of 72 ft on distribution system of Colorado River aqueduct; method of bending steel; moving forms and handling concrete; concrete characteristics.

WATER RESOURCES

NEW JERSEY. Water Supplies of Northeastern New Jersey, C. H. Capen, Jr. *Am. Water Works Assn.—J.*, vol. 29, no. 9, Sept. 1937, pp. 1308–1354. Review of water supply of New Jersey and its metropolitan area; early supplies; development after 1850; trend in development of watersheds; yield of Pequannock, Rockaway, Wanaque, and Passaic watersheds; population; growth in use of public supplies; water consumption needs; present supplies; agencies concerned with water supplies; comparison of projects; future program. Bibliography.

UNDERGROUND, UTAH. Geology and Ground-Water Resources of Ogden Valley, Utah, R. M. Leggette and G. H. Taylor. *U. S. Geol. Survey—Water-Supply Paper*, 796-D, 1937, 161 pp., supp. map, 10 cents. Study of underground water resources of valley near Ogden, Utah, having area of 23 sq miles; climate; geology; surface water; ground water occurrence; fluctuations of water level; recharge; discharge; relation of artesian discharge to stream flow; well records.

WATER TREATMENT

BACTERIOLOGY. Laboratory Control, C. R. Cox. *Water Works Eng.*, vol. 90, no. 10, May 12, 1937, pp. 577–578. Bacteriological procedures; sterilization of glassware; nutrient agar; lactose broth; endo agar; eosin methylene blue agar; brilliant-green bile broth; sterilization of media.

BACTERIOLOGY, ARIZONA. Hitherto Unrecorded Organism Discovered in Arizona Water, W. B. West. *Water Works Eng.*, vol. 90, no. 10, May 12, 1937, pp. 571 and 591. Study of organisms belonging to genus Pseudomonas found in water, ice cream, urine specimens, and tissue and organs of two deer, dead from unknown causes; relation to enteric infections. Before Soc. Am. Bacteriologists.

CHLORINATION. Ammonia and High Bacterial Counts, C. H. Burdick. *Water & Water Eng.*, vol. 39, no. 477, Apr. 1937, pp. 215–216. Experience of water-filtration plant of Flint, Mich., with ammoniation and chlorination of water.

CHLORINATION, SAN FRANCISCO, CALIF. Record Size Installation for Chloramine Treatment. *Western Construction News*, vol. 12, no. 4, Apr. 1937, pp. 140–141. Features of San Francisco Water Works chloramine treatment plant, now in course of construction, which will be capable of feeding 2,000 lb of chlorine and 400 lb of ammonia to prevent objectionable growths in 27 miles of aqueduct tunnel; chlorinators; chlorine discharge; ammoniators; chemical solution supply; special alarm system.

COAGULATION. Silicates as Aids to Coagulation, J. R. Baylis. *Am. Water Works Assn.—J.*, vol. 29, no. 9, Sept. 1937, pp. 1355–1392, (discussion) 1392–1396. Use of silicates as aid to coagulation of water with aluminum sulfate; experiments at Chicago; effects of acid-treated sodium silicate on coagulation with aluminum sulfate; preparation of silicate solutions; effect of alkalinity of silicate solution; of varying pH of water, and of age of silicate solution on coagulation with iron salts. Bibliography.

FILTRATION PLANTS, CONTROL. Water Filtration Plant Control. *Water & Water Eng.*, vol. 39, no. 477, Apr. 1937, pp. 228–229. Features of modern loss of head indicator; rate of flow indicator; filter operation tables.

PLANTS, CALIFORNIA. Modern Water Softening Plant Uses Welded Steel Sedimentation Basins, C. B. Neill. *Western Construction News*, vol. 12, no. 6, June 1937, pp. 209–211. Design and construction of new 3-mgd water-softening plant for use in Coronado District of California Water and Telephone Co. in San Diego County; ferric chloride used for coagulant; plant costs $20,000 per mg; organisms in pipe line; operating costs.

RAILROADS. Report of Committee XIII—Water Service, Fire Protection and Sanitation. *Am. Ry. Eng. Assn.—Proc.*, vol. 38, 1937, pp. 93–113, (discussion) 609–612. Relation of railway fire protection to municipal and privately owned waterworks; use of phosphates in water treatment; cause of and remedy for pitting and corrosion of locomotive boiler tubes and sheets; analysis of chemicals used in water treatment; progress being made by federal or state authorities on regulations pertaining to railway sanitation; reduction of water waste.

WATER WORKS ENGINEERING

HONG KONG. Water Supply of Hong Kong—III, C. A. M. Smith. *Water & Water Eng.*, vol. 39, no. 478, May 1937, pp. 260–263. Outline of Shing Mun water supply project; construction of Shing Mun concrete gravity dam, backed with hand-packed granite rock, having maximum height of about 300 ft and crest length of about 800 ft.

MAINTENANCE AND REPAIR. Back of Lines at Hartford, N. N. Wolpert. *Water Works Eng.*, vol. 90, no. 10, May 12, 1937, pp. 572–576. Repair methods and practices followed by Metropolitan District Commission, Hartford, Conn.; equipment used; instructions for repair men; use of emergency car; service material; range of meter tests; testing large meters; charge for damage to meters; central shops; distance meter.

OPERATION. Plugging Dollar Leaks in Water Works Systems, R. N. Clark. *Pub. Works*, vol. 68, no. 6, June 1937, pp. 25–28, 30, and 32. Principles of efficient management of modern water works, including pumps and engines; measuring devices; treatment devices; checking filter units; care of softening plant; handling and applying chlorine; distribution system; maintaining valve efficiency; leakage losses and surveys.

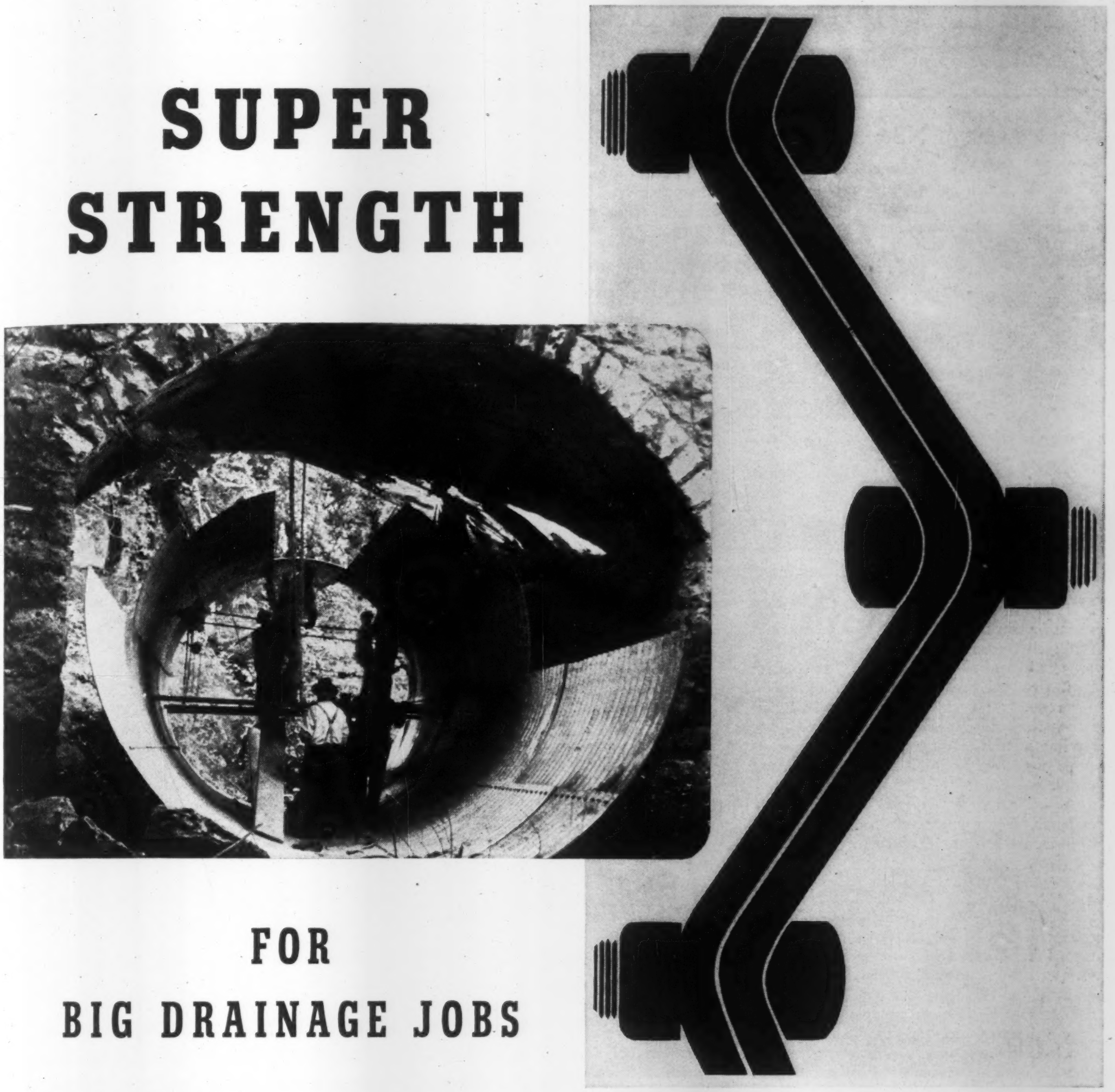
PUBLIC HEALTH. Water Supplies and Public Health, J. Smith. *Water & Water Eng.*, vol. 39, no. 478, May 1937, pp. 255–260. Chemical and bacteriological examination of water supplies; bacteriological control of Aberdeen water supply; water and its relation to disease; water-borne typhoid fever; recent outbreaks of enteric fever in Great Britain due to infected water supplies; lead poisoning and water supplies; filtration versus chlorination.

SPOKANE, WASH. Hydro-Power for Pumping Developed by Spokane Water Department, A. Lindsay. *Western Construction News*, vol. 12, no. 4, Apr. 1937, pp. 142–146. Description of new water works and hydroelectric power development of Spokane, Wash., involving construction of reinforced concrete spillway dam, which replaces 48-year-old timber crib spillway structure and new 5,400-hp power plant completed under $1,184,000 program; control works; dam construction; power house and intake works; power canal; concrete and aggregates.

TANKS AND TOWERS, CONCRETE. Elevated Concrete Tanks of Record Size, H. D. Dewell. *Eng. News-Rec.*, vol. 119, no. 19, Nov. 4, 1937, pp. 752–755. Design and construction of two 3,000,000-gal balancing reservoirs with encased welded steel shells and concrete bottoms on concrete supporting structures, 75-ft high, for water works of Sacramento, Calif.; details of tank walls; tank floor; foundations.

TANKS AND TOWERS, FROST PROTECTION. Prevention of Freezing in Elevated Tanks, C. L. Hubbard. *Power*, vol. 81, no. 11, Oct. 1937, pp. 605–606. Study of local weather records and heating device, either coil, mixing valve, or indirect heating, depending on tank and purpose it serves, provide anti-freezing combination.

SUPER STRENGTH



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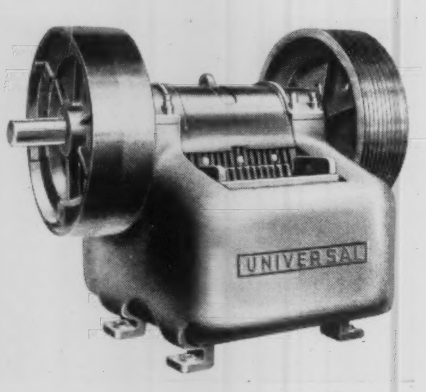
New Developments of Interest, as Reported by Manufacturers

Crusher of New Design

The Universal Crusher Company of Cedar Rapids, Iowa, announces a new crusher embodying the first major design change since the inception of jaw crushers in 1906.

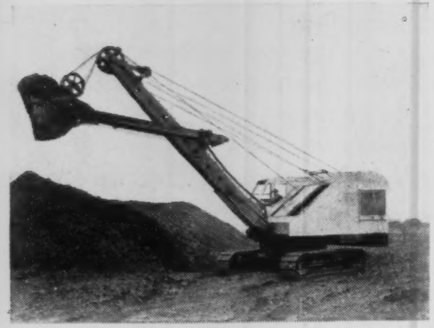


This new Universal crushing unit, the manufacturer claims, possesses unusual strength from the streamlined frame, plus weight savings that approximate 20% over conventional types of crushers. By reason of greater strength and lightness, the manufacturer states that big savings are effected in first cost, in shipping costs, in installation and operating costs.

A bulletin just issued on this new crusher, giving complete details, is available from the manufacturer.

Heavy-Duty Excavator

Harnishfeger Corporation presents the new P&H Model 555, as a fast $1^{1}/_{4}$-yd excavator. Among the many advantages claimed for this fully convertible machine are special compensator springs to provide uniform tension in the crawler track; shock-absorbing chain power drive; revolving upper deck on large roller bearing; hook rollers to protect center pin from all tipping strains; machinery on the upper deck placed behind the center of rotation; clutches operated by automotive-type controls; double-safety boom hoist; optional gas or Diesel engine power; vertical hand steering wheel; anti-friction bearings; 2-speed transmission; and centralized lubricating stations.



Further information on this new heavy-duty, convertible machine may be obtained by writing the Harnishfeger Corporation, Milwaukee, Wis.

Self-Powered Pile Driver

A pile driver that employs the Diesel principle to drive itself is the latest addition to the Delmag line of construction equipment, distributed by the Calhoun Company of Los Angeles, Calif. The unit, designed for driving light to medium piles and sheet piling, consists of a tripod rig and the driving mechanism, available in hammer weights of 660 and 1,000 lbs.

The driving assembly of the Delmag pile driver includes the hammer and the base block, which are connected by two guide rods. Projecting upward from the base block is a piston and contained in the hammer is a cylinder. When the hammer falls the piston compresses the air in the cylinder to about 440 lbs per sq in., and, at the same time, fuel is injected.

The resultant combustion throws the head upward and the cycle continues. The number of blows can be regulated by throttle over a range of 50 to 70 blows per minute, the length of stroke varying accordingly between $2^{1}/_{2}$ and 5 ft. The 660-lb hammer has a driving force of 3,630 lbs, the 990-lb hammer a driving force of 5,500 lbs.

Fuel consumption figures are reported to have shown an average of only 5 qts of Diesel oil per 8 hrs for the 660-lb pile driver, and 8 qts per 8 hrs for the 1,000-lb model. This pile driver is one of three self-powered pieces of construction equipment in the Delmag line.

F-M Duplex Steam Pump

A new duplex steam pump with eight-cover, side-pot type fluid end and improved piston valve steam end has been announced by Fairbanks, Morse & Co. This new Fig. 6,285 steam pump offers an economical means of handling oil, water, or other free-flowing liquids at high pressures and in large quantities. This pump was developed particularly for industrial and oil field boiler feed service, but is well suited to many general industrial, railroad, and municipal applications. Sizes are available for capacities up to 148 gpm and pressures up to 1,000 lb per sq in.

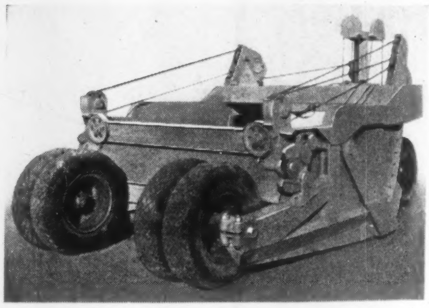
This same type of eight-cover, side-pot fluid end is available also in the F-M duplex power pumps for motor, belt, or engine drive. These have enclosed self-oiling power ends with herringbone gears and large roller bearings.

Bulletins, available from Fairbanks, Morse & Co., 900 S. Wabash, Ave., Chicago, Ill., describe fully the construction features of the new duplex steam pumps.

New Emsco Wheeled Scraper

The Tractor Equipment Division of the Emsco Derrick & Equipment Company, Chicago and Los Angeles, has announced a new type of wagon scraper.

Made in three sizes—a small, medium, and large size unit—the new Emsco Wheeled Scraper is light in weight compared to its digging and hauling capacity, and possesses ample rigidity and stability to eliminate body distortion.



Wheels are placed so as not to obstruct dumping or digging operations. Special oversize sheaves have been developed to lessen cable wear and to keep grit from their bearings. Wherever practical, oil-less bushings are used on these scrapers. A double drum power unit operates the scraper. A four drum power control unit will soon be available for tandem operations. The entire unit has a low center of gravity, permitting it to be operated on banks and steep grades. The new Emsco Wheeled Scraper is the most recent addition to the Emsco Line of road rippers, bulldozers, and graders.

It's KNOW HOW that counts in Wire Rope

And there's plenty of "know how" back of Bethlehem Wire Rope—the accumulated experience of half a century of wire-rope manufacture by the Williamsport Wire Rope Company, recently acquired by Bethlehem. Take Drag Line on a boom machine, for example. Highest-strength steel is always specified. 6 x 19 lang-lay construction is universally used. Yet, even with these two points standardized among all rope makers, Bethlehem Drag Line has won high favor among contractors.

"Know how" enables Bethlehem to build a perfected drag line—having definite features, unique in Bethlehem ropes, which combat abrasive wear and resist the whipping action of casting. For one thing, the strands, whether Form-Set (preformed) or standard, are "back turned." As wire is twisted into strand, the individual wires themselves are given a slight twist, making them hug together. Likewise, as the strands are twisted into rope, they, too, are twisted slightly, making a tight, solid surface that has greater resistance to abrasion. This same "back turning" balances internal stresses of the rope and makes it less kinky, less likely to bird-cage, easier to handle.

A small point, perhaps. Yet any contractor familiar with Bethlehem (formerly Williamsport) Rope can immediately tell the difference. Bethlehem rope casts better. It won't twist when let loose. It wears longer.

Whether it's Purple-Strand Perfected Drag Line, or wire rope for some other use, you'll find this "know how" invariably present in Bethlehem Lines.

BETHLEHEM STEEL

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New Electrode Holder

A new arc welding electrode holder, the feature of which is remarkably light weight for the capacity, has just been announced by The Lincoln Electric Company, Cleveland, Ohio.

The new holder, designated "Type ST," weighs only 14 oz and has a current capacity of 250 amperes continuous, equaling that of many type holders weighing 25 oz or over. The light weight, obtained without any sacrifice of capacity, is attributed to use of formed steel parts, electrically welded. Other advanced features include an extremely simple type of connection which assures positive contact; reduced overall width, permitting easier welding in corners and other confined places; rounded rather than square corners at important points to lessen the likelihood of contacting the holder and causing arcing; use of heavier copper jaws to assure maximum conductivity and prevent sticking of the electrode to the holder; grooving of the jaws for vertical and overhead as well as flat welding; a hollow fibre handle, correctly proportioned to fit the user's hand and afford a positive grip; fully insulated thumb lever and non-groundable spring.

The "Type ST" holder will accommodate any size electrode up to and including $^1/_4$ in.

Marion Small Shovel

A new $^3/_4$ cu yd excavator has been placed on the market by the Marion Steam Shovel Company, Marion, Ohio. This machine, the 1937 Type 331, is a powerful and compact excavator built to work in close clearances. Because of its mobility and ease of operation it is reported to be ideal for crane service.

Self-cleaning, non-binding crawlers; boom of tubular construction for maximum strength; full capacity $^3/_4$ cu yd manganese steel front dipper; full welded construction throughout; simple arrangement of controls; and ease of convertibility are a few of the features of design and construction.

Concrete Paver

Blaw-Knox Company, Pittsburgh, Penna., has developed a gas-electric concrete paving finisher said to be able to strike off and surface finish 2,000 to 2,400 ft of pavement per day in 18 or 20 ft widths. Two rocking surfacers smooth the concrete surface as the machine travels slowly along the road forms. Concrete poured from the paver is leveled off by the same method. A gasoline motor generates power for the operating motors.

Draftsmen's Lamps

The extreme mobility of a recent lighting innovation for draftsmen's tables, drawing boards, and other expansive working surfaces, is shown by the triple-exposure photograph used in the illustration. The double swinging arm of this Greist White Knight can be extended twenty-four inches in any direction and the lamp held in the desired position with set screws at both turning points. The new "Corrected Light" unit was developed by the Greist Manufacturing Company, New Haven, Conn. Genuine bronze or gunmetal plate with silver-plated trim are the finishes.

"Corrected Light" is accomplished with an exclusive luminaire of Celestialite, a triple layer glass, under the metal shade. According to the manufacturer's report, the three laminated glass layers—blue, opal, and clear—whiten and diffuse the light, removing the distorting and harmful yellow rays, minimizing glare, and producing a light comparable to subdued daylight. Color contrasts are intensified under the white light, increasing visual acuity by strengthening detail. Intensities with the recommended 100 watt bulb are said to conform to optical standards for close visual work.

Folders Announced

COMPRESSORS—A 24-page catalog, "Sullivan Plus Portable Compressors" describes the complete line of two-stage portable air compressors, with specifications and technical data. Sullivan Machinery Co., Michigan City, Ind.

CONCRETE PLANK—A light weight tongue and groove concrete plank, called "Cantilite," for floors and roofs, is described in an 8-page folder. Concrete Plank Co., 50 Sussex St., Jersey City, N.J.

CRUSHERS—The Universal Crusher Company has just issued Bulletin #100 covering their line of Bronze Bearing Jaw Crushers; Bulletin #200 covering their line of Roller Bearing Jaw Crushers; Bulletin #300 covering Universal Roll Crushers; and Folder #19 covering Universal 30-Q Portable Plants. Each bulletin gives complete construction details, dimensions, specifications, and other data. Universal Crusher Company, 625 C Ave., N.W., Cedar Rapids, Iowa.

EXPLOSIVES—"Twenty-Five Years," a beautifully printed 64-page book, commemorates a quarter of a century's service to industry by The Atlas Powder Company. It is an interesting and informative history of the development of the many products of the Company. The Atlas Powder Co., Wilmington, Del.

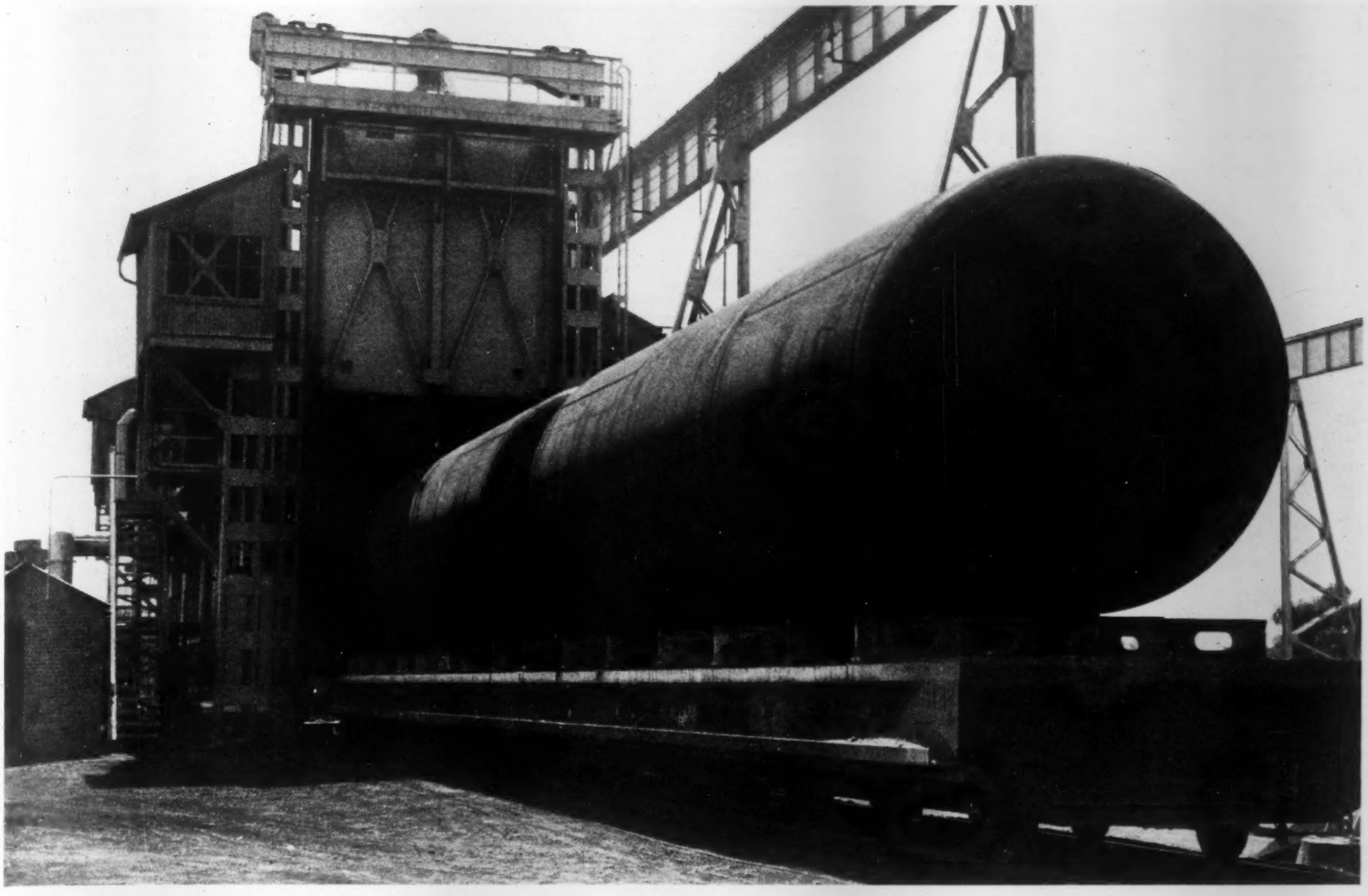
METEOROLOGICAL AND HYDROLOGICAL INSTRUMENTS—A general catalog of 102 pages illustrates and describes the full line of this equipment. Julien P. Friez & Sons, Inc., Baltimore, Md.

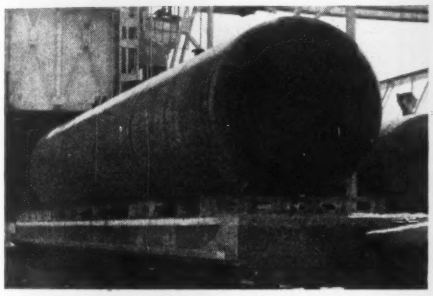
ROCK DRILL—A virtual encyclopedia of rock drills and associated equipment, including jackhammers, paving breakers, drifters, stopehammers, wagon drills, jackbits, drill steel, sharpeners, furnaces and blacksmith equipment including jackrod threading devices, calyx, and diamond drills, is presented, with eight pages of such useful information as metric conversion tables, friction of air in pipes and hose, horsepowers required to compress given quantities of air to specified pressures, and compressor capacities required to operate from one to seventy drills, in a new catalog recently published by Ingersoll-Rand Company, 11 Broadway, New York, N.Y.

STEEL SHEET PILING BOOK—An illustrated booklet shows a wide range of steel sheet piling installations, also the shapes and sizes of piling sections rolled, and offers a Coffer Dam Calculator developed by the Inland Engineering Department, Inland Steel Co., Chicago, Ill.

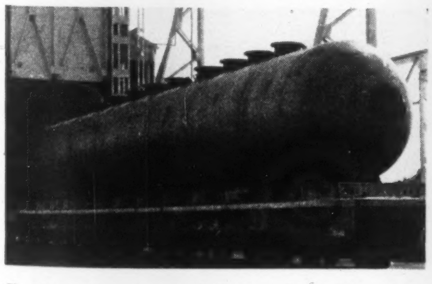
WATER WELL DRILL—Bulletin No. 21-W-2 illustrates and describes the Bucyrus-Armstrong 21-W Water Well Drill, with field action photographs and pictures of machinery, derrick, controls, etc. Bucyrus-Erie Company, South Milwaukee, Wis.

WELDING—"How to Change Over to Welded Design for Profits," a new 32-page, $8^1/_2 \times 11$ in. illustrated bulletin, outlines the application of electric welding to the design of machines and machinery structures, and sets forth the experiences of many manufacturers who have redesigned their products for arc welded construction. The Lincoln Electric Company, 12818 Coit Road, Cleveland, Ohio.





Stress relieved prophane tank 8 ft. 10 in. diameter by 63 ft. 8 in. long ready for shipment from Birmingham.



Fractionating tower fabricated at Birmingham for installation in an oil refinery in Ponca City, Okla. It is 8 ft. 7 in. dia. by 67 ft. 9 in. long.

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The above view shows two 10 ft. diameter oil refinery tanks designed to operate at 100 lbs. per sq. in. as they were being taken out of the furnace. The inside dimensions of the furnace are 14 ft. wide by 17 ft. 4 in. high by 80 ft. long. Vessels longer than 80 ft. are permitted to project first out one end and then the other until the entire length is stress relieved.

Other products which we build include flat-bottom storage tanks of welded or riveted construction, elevated tanks, spherical and spheroidal tanks for the storages of liquids and gases under pressure, steel filter plants, bins, smokestacks and steel plate work of all kinds. Write our nearest office for information or quotations.

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B-561

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Civil Engineer; Jun. Am. Soc. C.E.; college graduate with B.C.E. degree; age 24; has about two years surveying and drafting experience. Desires position with contractor, builder, engineer, architect, or political subdivision. Location immaterial. C-287.

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Associate Professor; Assoc. M. Am. Soc. C.E.; 11 years in design of buildings and bridges; 4 years teaching structural engineering, theoretical and applied mechanics; desires to make teaching change. Has C.E., M.S., and D.Sc. degrees. At present teaching above subjects in large university. Location East or South preferred. Available September 1938. C-286.

Civil Engineer; Jun. Am. Soc. C.E.; single; 32; M.S. in C.E.; licensed professional engineer; 11 years experience in field work, tutoring, structural design, including office buildings, incinerators, power plants, and rigid frames. Proven executive ability and progressiveness. Desires permanent position teaching structures, mechanics, or allied subjects. C-288.

Professor Civil and/or Hydraulic Engineering; M. Am. Soc. C.E.; married; family; $18\frac{1}{2}$ years educational experience; $14\frac{1}{2}$ years in administration; 6 years in hydraulics; $8\frac{1}{2}$ years outside construction. Distinct ability to organize and handle men. Expert in teaching all phases of hydraulics. Now employed. C-266.

Civil-Hydraulic Engineer; Assoc. M. Am. Soc. C.E.; married; 44; B.S.C.E.; 22 years experience, including flood control, water-supply studies, storm-drain design; 3 years as head of civil engineering and mathematics department, teaching mechanics, hydraulics, calculus, etc. Desires position with organization engaged in water-supply, irrigation, or hydraulic work, or teaching position with opportunity for hydraulic research and graduate study. C-274.

Civil Engineer; M. Am. Soc. C.E.; 37 years old; now in responsible charge of dam construction, including placing and testing a million yards of rolled earth fill; desires teaching position in civil engineering department of university with opportunity for work in soil mechanics. Location immaterial. Available September. C-284.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Advanced Calculus. By W. B. Fite. New York, Macmillan Co., 1938. 399 pp., diagrs., tables, 9 × 6 in., cloth, $5.

The student who intends to specialize in mathematics will find here "an introductory course in mathematical analysis." Assuming familiarity with the basic operations of the calculus, the book discusses functions of more than one variable, indefinite, infinite and multiple integrals, various types of series, and applications to geometry. The calculus of variations and functions of a complex variable are treated briefly.

American Planning and Civic Annual. Edited by Harlean James. Washington, D.C., American Planning and Civic Association, 1937. 404 pp., illus., tables, 9 × 6 in., cloth, $3.

A collection of papers, presented at various national and regional conferences on national regional, or city planning, and state park development, is included in this volume. They are presented as a survey of current work in these fields leading towards the improvement of the living, working, and recreational conditions of the American people.

Architectural Design of Concrete Bridges. Published by the Portland Cement Association, Chicago (33 West Grand Avenue), 1937. 36 pp., illus., diagrs., $11 \times 8\frac{1}{2}$ in., paper.

This new publication by the Portland Cement Association presents fundamental principles of architectural design, restated with particular reference to bridge design. The principles—unity, definition, and inflection—are discussed in detail, and their application to a number of practical cases of bridge construction is illustrated. Three artists' renderings and many photographs are included.

Asphalts and Allied Substances, 4 ed. By H. Abraham. New York, D. Van Nostrand Co., 1938. 1491 pp., illus., diagrs., maps, charts, tables, 9 × 6 in., leather, $12.50.

This is an extremely comprehensive treatise on the subject. Following a good historical résumé, comes information on the classification, chemistry, geology, origin, and annual production of bituminous substances. The description, sources, and production methods of solid and semi-solid bitumens, tars and pitches, and pyrogenous asphalts and waxes are given. The manufactured products and their many uses are considered in detail, and methods of testing for both raw and manufactured materials are described.

Barrages. 3 vols. (Actualités Scientifiques et Industrielles, 476–478.) By L. Escande. Edited by C. Camichel. Paris, Hermann & Co., 1937. Illus., diagrs. charts, tables, 10 × 7 in., paper, 20 francs per volume.

The first part of this treatise on the design of large dams treats of those with a triangular profile. After establishing directly the general equations of elasticity, their application to large dams is developed. A series of graphic diagrams from which the characteristics of a dam for a given site may be obtained without calculation is also developed. The second part consists of a study of the phenomena of overflow and the determination of the best profile for overflow dams.

Building Estimator's Reference Book, 8 ed. By F. R. Walker. Chicago, Frank R. Walker Co., 1937. 1682 pp., illus., diagrs., charts, tables, 7 × 4 in., leather, $10, including "Vest-Pocket Estimator," 220 pp., 6 × 3 in., leather.

A comprehensive treatment of the various items which may be required for the accurate estimation of a contracting job. Beginning with the general question of preparing a properly safeguarded estimate, the book then discusses overhead expenses and continues with detailed information as to materials, costs, equipment, and labor for everything from excavation to small hardware. A special feature is the illustrative set-ups of cost calculations, into which can be inserted local prices and costs. Condensed estimating information is found in the "Vest-Pocket Estimator" which accompanies the main volume.

The Construction of Main Sewers and the Timbering of Excavations. By C. G. Kent (assisted by J. C. Morris). London and New York, Longmans, Green and Company, 1937. 286 pp., illus., tables, diagrs., charts, $8\frac{1}{2} \times 5\frac{1}{2}$ in., cloth $8.

This book, based on the author's own experience, describes in detail construction in open cut and tunnel, organizing work, and keeping records. There are sections on work under compressed air; shield tunneling; the ventilation of tunnels; methods of timbering trenches, shafts, and tunnels in all kinds of ground; methods employed in constructing special works; and similar subjects.

Engineering Law. By R. E. Laidlaw and C. R. Young. Toronto, University of Toronto Press, 1937. 380 pp., tables, 9 × 6 in., cloth, $4.

Not intended as a legal text, this book gives salient facts concerning contracts, specifications, industrial disputes, patents, company organization, and questions in connection with boundaries, surveys, and other technical matters. The authors are Canadian authorities, and the references are to Canadian and English law reports.

George Westinghouse Commemoration. Published by the American Society of Mechanical Engineers, New York (29 West 39th Street), 1937. 78 pp., illus., 11 × 8 in., cardboard, complimentary.

A forum presenting the career and achievements of George Westinghouse (1846–1914) was conducted by the American Society of Mechanical Engineers on the ninetieth anniversary of his birth. The present commemorative volume consists of the addresses given on that occasion by engineers associated with Mr. Westinghouse and by others who attempted to evaluate his service to the profession.

Highway Design and Construction, 2 ed. By A. G. Bruce. Scranton, Pa., International Textbook Co., 1937. 646 pp., illus., diagrs., charts, tables, 9 × 5 in., leather, $4.

In this concise, yet comprehensive treatise on current practice, attention is focused upon the fundamental principles of design and construction. The latest, generally accepted practice is described in clear, understandable form, and references to sources of additional information are provided.

International Association for Testing Materials, London Congress, April 19–24, 1937. London, International Association for Testing Materials (28 Victoria St., London, S.W.1), 1937. 661 pp., illus., diagrs., charts, tables, 11 × 7 in., cloth, 30 s.

This volume contains the proceedings and papers of the London Congress, at which the following topics were discussed: The Effect of Temperature Upon the Mechanical and Chemical Behavior of Metals; The Progress of Metallography; Light Metals and Their Alloys; Workability and Wear of Metals; Concrete and Reinforced Concrete; Natural Stone; Ceramic Materials; Textiles; Wood Cellulose; Timber Preservation; Aging of Organic Materials; Colors and Varnishes; The Relation Between the Results of Laboratory Tests and Behavior in Use and Service; The Bearing of Recent Advances in Physics and Chemistry on the Knowledge of Materials; The Properties of Materials for the Thermal and Acoustic Insulation of Buildings.

Modern Construction, Specifications and Standards. Prepared by E. E. R. Tratman. New York, McGraw-Hill Book Co., 1936. 254 pp., diagrs., tables, leather (not for sale; free to new subscribers to *Engineering News-Record*).

This volume consists largely of abstracts of a wide variety of specifications issued by technical societies and public authorities. These include examples of general specifications for paving, sewers, and other construction work; standard specifications for various materials and such construction units as pipe, brick, and steel reinforcement; and standards used in the design of bridges, buildings, and masonry. Details of practice and workmanship in the construction of sewers, paving, and buildings are given, as well as the regulatory standards of building codes and sanitary regulations. In addition, the book contains abstracts of construction contracts indicating the general requirements, duties, and responsibilities, and a series of drawings of standard designs.

Praktische Anwendung der Baugrunduntersuchungen, 3 ed. By W. Loos. Berlin, Julius Springer, 1937. 204 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, 18 rm.

This treatise is intended to make available to the practicing engineer the results of researches in soil mechanics, especially as applicable to foundation work. This edition has been rewritten and enlarged to include the results of the most recent investigations. There is a bibliography.

Procedure Handbook of Arc Welding Design and Practice, 5 ed. Cleveland, The Lincoln Electric Company, 1938. 1012 pp., illus., tables, diagrs., charts, $8\frac{1}{2} \times 5\frac{1}{2}$ in., simulated leather ($1.50 in the United States; $2 elsewhere).

This revision of the fourth edition of the Handbook, taking into account recent developments in arc welding, includes new or revised information on the following subjects: Characteristics of the Welding Generator; A. W. S. Weld Symbols; Welding Costs; High Speed Automatic Welding; High Tensile Steels; Cold Rolled Steel; Medium High Carbon Steel; Chrome Steel; S. A. E. Steel Numbering System; A. W. S. Filler Metal Specifications; Machine Design; and Structural Design. New welding applications throughout the many industrial fields are also given.

Reinforced Concrete Pavements. By Royall D. Bradbury. Washington, D.C., Wire Reinforcement Institute, 1938. 190 pp., illus., diagrs., tables, charts, 9 × 6 in., leather.

The scope of this volume is limited to those aspects of highway engineering which involve the structural design and analysis of concrete pavements and pavement bases. So far as possible, the text has been confined to fundamentals rather than special cases, although it has been found advisable to resort to the use of many numerical examples. Stress-production conditions are enumerated and discussed, and theoretical stress analysis is then briefly reviewed and certain fundamental stress formulas are presented.

Technical Mathematics, 2 ed., 3 Vols. By H. M. Keal and C. J. Leonard. New York and London, John Wiley & Sons, 1938. Vol. 1, 246 pp.; Vol. 2, 277 pp.; Vol. 3, 314 pp., illus, diagrs., charts, tables, 7 × 5 in., cloth, $1.25 per volume.

The three volumes of this secondary, or trade school, textbook treat, respectively, the subjects of algebra, geometry, and trigonometry. The object is to provide a sound basis for future technical education as well as for actual shop, laboratory, or drawing-room work. The third volume also contains illustrative practical problems and a section on the use of the slide rule.

Wood Preservation. By George M. Hunt and George A. Garratt. New York and London, McGraw-Hill Book Company, Inc., 1938. 457 pp., illus., diagrs., tables, charts, 9 × 6 in., cloth, $5.

A dual purpose is filled by this up-to-date book, which will serve both as a text for engineering students and as a reference volume for those engaged in the wood-preserving industry and for purchasing agents and engineers concerned with the use of wood. The volume attempts to summarize the essential facts in the extensive literature on the subject of wood preservation and to give an orderly presentation of the fundamental principles.

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BRIDGES

Concrete Arch, Ontario. Deep Ravines Spanned by Two Large Bridges on New Toronto–Hamilton Superhighway, A. Sedgwick. *Eng. & Contract Rec.*, vol. 50, no. 61, Feb. 24, 1937, pp. 18–22, and 24. Description of Sixteen-Mile Creek and Twelve-Mile Creek Bridges on Middle Road between Toronto and Hamilton; structures are of similar general design with lengths of 616 and 645 ft overall; main arch spans of 135 ft, each with 50-ft beam spans, carrying roadways 40 ft in width; new type of expansion joint.

Concrete Arch, Stresses. Model Analysis of Arch Span of 344 Feet, M. G. Bull. *Instn. Engrs. Australia—J.*, vol. 9, no. 2, February 1937, pp. 58–67. Model investigation of stresses in main 344-ft arch span of bridge over Long Bay between North Sydney and Willoughby, New South Wales; analysis by means of Beggs' deformeter apparatus; calculations for live-load influence lines; accuracy of results; analysis of stresses in arch ribs and superstructure; analysis of temperature stresses in arch ribs and superstructure.

Highway, Construction. Trends in Bridge Construction on Ontario Highways System, A. Sedgwick. *Eng. & Contract Rec.*, vol. 50, no. 65, Mar. 24, 1937, pp. 11–13. Development of vibratory placing of concrete; use of creosoted timber; application of welding to steel frames and concrete reinforcing; changes in wing-wall design; use of creosoted timber for bridges.

Masonry Arch, Centering. Centering of Masonry Bridge. *Engineer*, vol. 164, no. 4269, Nov. 5, 1937, p. 514. Method employed on bridge over Abi-i-Diz in Karoun Valley; centering was constructed of timber made up into panels and erected by use of 1-ton cranes; it was erected in form of half-arch on each side of river and supported on masonry bearing by pin joint. From *Génie Civil*, date not specified.

Masonry Arch, Widening. Widening an Arch Road Bridge, W. A. Ozanne. *Commonwealth Engr.*, vol. 24, no. 8, Mar. 1, 1937, pp. 275–279. Reconstruction of 80-year-old, 80-ft span, masonry-arch bridge of Heidelberg highway near Melbourne, Australia; increasing its width from 29 ft to 66 ft; structural details and cost data.

Steel Arch. Die Storstroembruecke, T. von Rothe. *Verkehrstechnik*, vol. 18, no. 21, Nov. 5, 1937, pp. 508–509. General illustrated description of Storstroem Bridge for combined highway and railroad service between Denmark and mainland of Germany; length of 10,534 ft makes it longest bridge in Europe; 49 concrete piers; three steel plate-girder navigation spans with polygonal arch reinforcements.

Steel Welding. Tendances actualles en matière de construction métallique soudée, A. Goelzer. *Ossature Métallique*, vol. 60, no. 5, May 1937, pp. 235–250. Review of papers and discussions on present tendencies in welded steel construction, presented at 1936 meeting of International Association on Bridges and Framed Structures; welded steel construction of bridges in Germany, Sweden, Norway, and France.

Suspension, Golden Gate. Spanning Golden Gate, L. K. Reinhardt. *Bldg. Standards Monthly*, vol. 6, no. 5, May 1937, pp. 3–6. General discussion of design and construction of Golden Gate suspension bridge near San Francisco, Calif., with special reference to safety provisions; comparison of materials and labor in Golden Gate and San Francisco Bay bridges.

Viaducts, Germany. Die Reichssautobahnbruecke ueber das Urselbachtal, Ernst. *Bautechnik*, vol. 15 no. 27/28, June 25, 1937, pp. 358–368. Design and construction of twin viaduct, consisting of seven 45-m spans over Urselbach Valley, for one of Germany's superhighway lines; width of each viaduct is 13.3 m; structural details of girders and supporting members.

BUILDINGS

Exhibitions, New York City. Design of Storm Water Sewers Draining World's Fair Area, J. F. Perrine. *Mun. Engrs. J.*, vol. 23, 3d quarterly issue, 1937, pp. 69–82. Development of plan and design of storm-water sewer system for Flushing Meadow Park drainage basin, covering area of 10,387 acres; capacity 5,200 cu ft per sec.

Public Buildings, British Columbia. Modern Building Trends Fully Developed in Vancouver's New City Hall. *Eng. & Contract Rev.*, vol. 50, no. 66, Mar. 31, 1937, pp. 7–10. Description of 12-story city hall in Vancouver, B.C., recently completed; decorative treatment and layout; heating and mechanical service; electrical work.

Stadiums, Concrete. Jersey City's New Stadium Utilizes Concrete. *Concrete*, vol. 45, no. 9, September 1937, pp. 9–10. Description of 20,000-cu yd structure capable of seating 41,000 people; details of concrete pile foundation; provision for future extension.

Swimming Pools, Indoor. Human Aquarium. *Engineer*, vol. 164, no. 4269, Nov. 5, 1937, p. 504. Brief illustrated description of building, built by French Office Nationale des Recherches et Inventions, intended to permit displays of fancy swimming under water, and displays of diving apparatus in operation; consists of circular basin; sides sloping toward 45 deg are made of plate glass and permit spectators to see what is going on in interior of basin.

CITY AND REGIONAL PLANNING

Central Areas. Proportion of Site to Be Covered by Buildings with Special Reference to Built-up Areas, J. J. Brooks. *Surveyor*, vol. 91, no. 2369, June 18, 1937, pp. 844A–844B. Theoretical discussion of proportion of site that may be covered by buildings, having special reference to those areas which are primarily built-up and which may be termed central areas; minimum sizes of plots; business premises.

Ribbon Development. La citta lineare, C. Albertini. *Strade*, vol. 19, no. 4, April 1937, pp. 233–236. Application of ribbon development in replanning of Madrid, Spain.

CONCRETE

Aggregates, Moisture Content. Moisture Content Control of Aggregates for Concrete. *Quarry & Roadmaking*, vol. 42, no. 487, March 1937, pp. 67–69. Outline of new method for ensuring greater uniformity in strength and other properties of concrete for roadmaking, or building construction, devised by Building Research Station of Department of Scientific and Industrial Research and described in *Road Research Technical Paper No. 4;* water requirements of concrete mix; aggregate vibration method.

Beams. Construction Design Chart—XIX—Reinforced Concrete Beams, J. R. Griffith. *Western Construction News*, vol. 12, no. 7, July 1937, p. 286. Construction of alignment chart for design of concrete beams with balanced tensile reinforcement; numerical examples.

Building Materials, Specifications. Report of Committee VIII—Masonry. *Am. Ry. Eng. Assn.—Bul.*, vol. 39, no. 399, November 1937, pp. 135–151. Revision of manual; specifications for portland cement concrete, plain and reinforced; specifications and principles of design of plain and reinforced concrete and of brick; progress in science and art of concrete manufacture; specifications for foundations; placement of concrete by pumping.

Construction. Ingenious Concrete Placing Methods at Golden Gate Exposition, P. Conant. *Concrete*, vol. 45, no. 12, December 1937, pp. 5–7. Contractors devise unusual arrangements for handling aggregates and concrete under difficult conditions; large permanent buildings of concrete and steel built to serve later as units in huge airport; walls of hangars designed to counter balance thrust of arched roof trusses.

Construction, Europe. Current European Concrete Practice, J. M. Antill. *Commonwealth Engr.*, vol. 24, nos. 8 and 9, Mar. 1, 1937, pp. 261–265, and April, pp. 299–302. March 1: Survey covering various types of cement, now in use; strengths and setting temperature of various cements; trends of design; concrete construction for Mareges and Chambon dams in France. April 1: Proportioning of mixtures; manufacturing and placing; Bolomey aggregate grading curve; German regulation for aggregates for reinforced concrete.

Construction, Prefabricated. Pre-Cast Concrete Units in Engineering Construction, R. E. Chadwick. *Eng. J.*, vol. 20, no. 9, September 1937, pp. 696–705. Considerations governing use of large pre-cast construction units, such as caissons, cribs, floor slabs, concrete blocks, piles, tunnel sections, etc.; methods of transportation and protection against erosion. Before Eng. Inst. Canada.

CONSTRUCTION INDUSTRY

Flood Problems. How Will Floods of 1937 Affect Construction, B. S. Smith. *Concrete*, vol. 45, no. 6, June 1937, pp. 7–9. Repair and replacement of structures and highways that were damaged or carried away, protective structures to safeguard individual communities, and flood protection projects comprising entire river valleys are likely to make heavy demands on construction industry.

DAMS

Concrete Arch, Construction. Construction of Mount Bold Reservoir Dam on River Onkaparinga, South Australia, H. H. Cartledge. *Instn. Engrs. Australia—J.*, vol. 9, no. 1, January 1937, pp. 17–23. Equipment and methods used in construction of Mount Bold concrete arch dam, near Adelaide, South Australia, necessitating excavation of 108,000 cu yd of earth and rock and placing of 132,000 cu yd of concrete; method of river control; driving of outlet tunnel, construction of stilling pool, and building of cut-off walls.

Earth, Construction. Contractor on Cajalco Dam Handling 12,000 Cu Yd of Earth Fill per Day. *Western Construction News*, vol. 12, no. 7, July 1937, pp. 275–278. Progress report of construction of earth-fill, 194 ft maximum height, for Cajalco Reservoir near Riverside, Calif.; preparing fill material; compacting material; testing procedure; concrete facing.

Fish Ladders, Construction. Welding Procedure Used in Fabricating Heavy Frames, V. C. Haner. *Western Construction News*, vol. 12, no. 8, August 1937, pp. 324–325. Analysis of methods and costs in making 40 units for fish-collecting system on Bonneville Dam project; design features and details; production details; jigs used in assembly.

Multiple Arch, Algeria. Le Barrage des Beni-Bahdel, A. Stucky. *Bul. Technique de la Suisse Romande*, vol. 63, no. 12, June 5, 1937, pp. 141–153. Design and construction of multiple-arch reinforced concrete dam of Beni-Bahdel in Department of Oran, Algeria, having total length of 320 m and maximum height of 57 m; arch spans are 20 m; geophysical exploration of dam site; analysis of arch stresses.

Reservoirs, Concrete. Placing 20 Acres of Concrete Slab to Line and Roof Reservoir. *Western Construction News*, vol. 12, no. 8, August 1937, pp. 290–292. Placing more than 20 acres of reinforced-concrete slab, almost half of it supported on 28-ft concrete columns, in lining and roofing new University Mound Reservoir of San Francisco Water Department, with capacity of 90 mg; sub-base preparation; pouring slopes and bottom; planning falsework.

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DOUBLE PURPOSE *Note the perfect alignment and simplicity of this trestle in Clay County, Florida. Here in an effective double purpose design U·S·S Steel Bearing Piles act both as bearing piles and trestle bent columns.*

True enough—yet Engineers say: "U·S·S STEEL BEARING PILES prove practical and economical on such widely different jobs as these."

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UNITED STATES STEEL

Rock Fill, Construction. Contractor's Maintenance Program for Equipment Used on San Gabriel Dam. *Western Construction News*, vol. 12, no. 8, August 1937, pp. 298–301. Planning and supervision of servicing schedule in construction operations handling 1,000,000 cu yd of rock fill per month; organization and direction of maintenance; shop and shop equipment; truck lubrication; equipment used; making out reports.

Weirs, Cipolletti. Construction Design Chart—XX—Cipolletti Weir Discharge, J. R. Griffith. *Western Construction News*, vol. 12, no. 8, August 1937, p. 326. Construction of alignment chart for computing discharge of Cipolletti weirs; numerical examples.

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SEWERAGE AND SEWAGE DISPOSAL

Comparisons. Combined Treatment of Garbage and Sewerage—Where Does It Stand? S. L. Tolman. *Mun. Sanitation*, vol. 8, no. 6, June 1937, pp. 313–316. Comparison of results and basic assumptions; studies of raw garbage; effect of ground garbage upon raw sewerage; effect of ground garbage on primary settling tanks; Babbitt test procedure; effect on secondary treatment at Indianapolis; operation of activated sludge and plain aeration plants; summary of digestion experiments. Bibliography.

Design of Plants. Lansing Links Sewage and Garbage Disposal, W. R. Drury. *Mun. Sanitation*, vol. 8, no. 9, Sept. 1937, pp. 444–447. Design and construction of sewage and garbage-disposal plant in Lansing, Mich., serving population of 100,000; garbage collection system; ground garbage to be digested and sludge reduced to ash.

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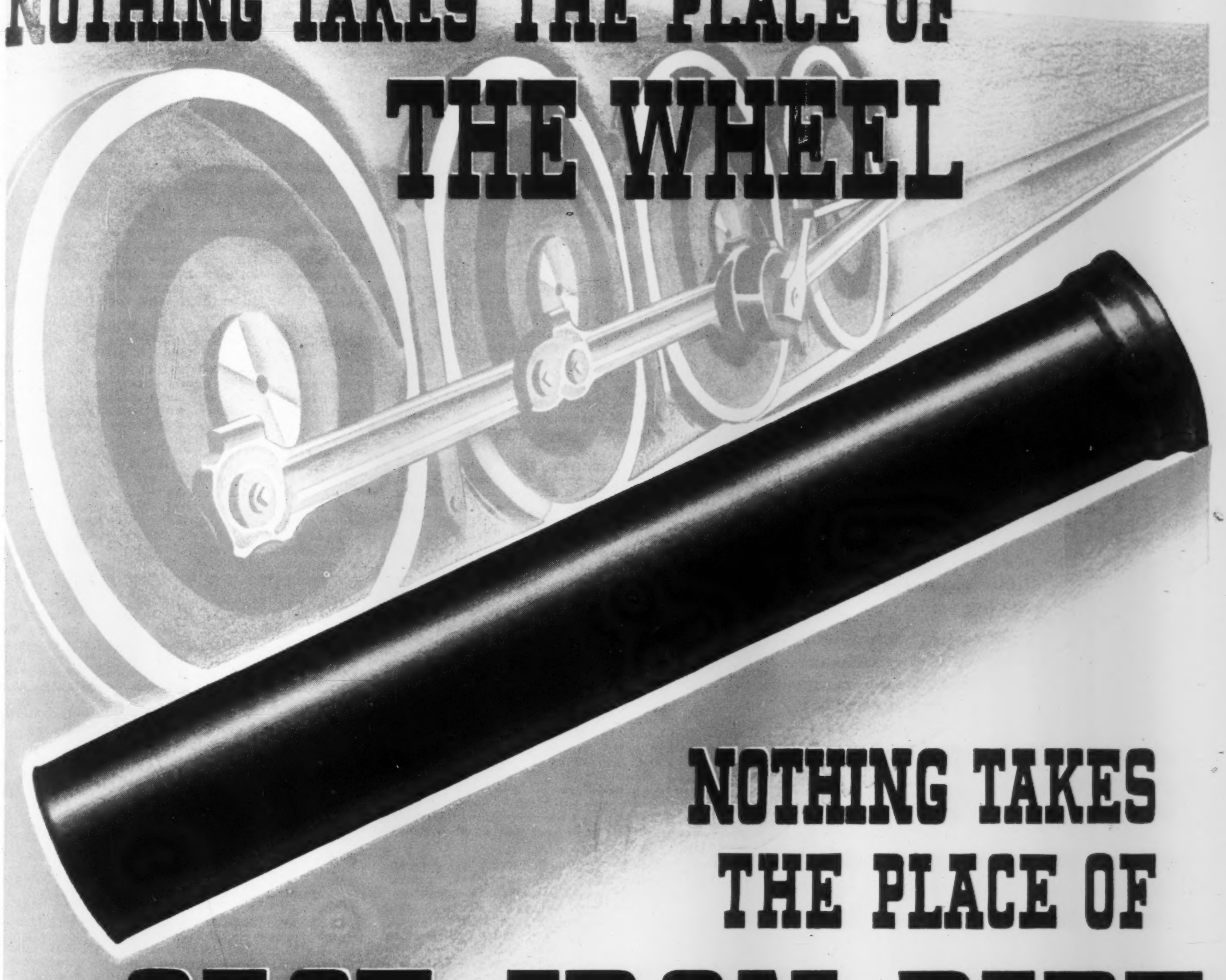

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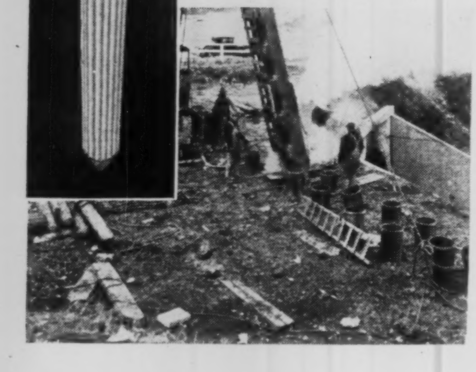

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PLANTS, HIGHLAND PARK, ILL. "Skyscraper" Sewage Treatment Plant for Highland Park, Ill., J. W. Nemoyer. *Mun. Sanitation*, vol. 8, no. 8, August 1937, pp. 404–406. Design and construction of new Highland Park, Ill., sewage-disposal plant treating average flow of 0.9 mgd; design was governed by limited area available for site, which measured only 50 ft by 100 ft.

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PLANTS, NEW JERSEY, Joint Treatment Works, A. Potter. *Mun. Sanitation*, vol. 8, nos. 8 and 9, August 1937, pp. 400–403, and September, pp. 451–454 and 470. August: History and description of joint treatment works situated in Elizabeth, N.J., to serve 11 municipalities in Elizabeth and Rahway River valleys; average daily sewage flow 27 mgd; cost of sea disposal. September: Sludge-thickener operations; sludge storage works; sludge forces main; typical analysis of raw sewage and plant effluent; construction costs of treatment plant; administration.

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TUNNELS

AQUEDUCTS, COLORADO RIVER. Fight Continues Against Water Flows in Tunnel Driving at San Jacinto. *Western Construction News*, vol. 12, no. 7, July 1937, pp. 246–250. Progress report on construction of 8.43-mile central section of San Jacinto Tunnel with special reference to method of combatting flow from water veins; construction of pumping station at bottom of shaft having total capacity of 10,000 gal per min for 275-ft head; driving in heading; pioneer tunnels; gunite rings used as temporary lining support.

VEHICULAR, NEW YORK. Tunnel Design Provides Safety and Economy, J. N. Dodd. *Elec. World*, vol. 109, no. 1, Jan. 1, 1938, pp. 29–31, and 93–94. Several developments of broad engineering interest mark electrical design of new Lincoln vehicular tunnel under Hudson River at 39th Street, New York City; multiple source of power, 4-speed fan drives, tuned frequency control of multi-speed motors, supervisory control, and modern lighting features.

VEHICULAR, OREGON. Driving Longest Tunnel on Oregon's Highway System, F. D. Eason. *Western Construction News*, vol. 12, no. 7, July 1937, pp. 253–254. Construction of Arch Cape Tunnel, 1,228 ft long, 32 miles south of Astoria, Oregon.

WATER RESOURCES

ILLINOIS. Preliminary Data on Surface Water Resources. *Ill. State Water Survey—Bul. No. 31*, 1937, 157 pp. Preliminary report including lists of 302 natural lakes with their location and area, 210 private and public reservoirs with their storage capacity and watershed area, and 587 possible reservoir sites as determined by office study of topographic maps.

UNITED STATES. Hundreds of Millions Required for Water Supply Work. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 743–744. Final installment from National Resources Committee Report presenting water-supply projects in western Gulf, Colorado, Great Basin, California, and Pacific Northwest regions.

WATER TREATMENT

BACTERIOLOGY. Bacteriological Researches in Water Works Field, H. J. Howard. *Eng. & Contract Rec.*, vol. 50, no. 64, Mar. 17, 1937, pp. 11–12. Abstract of portion of London Metropolitan Water Board's annual report, outlining details of important bacteriological researches; streptococcus tests; clostridium Welchii test; aftergrowths in treated water; paratyphoid B; Eijkman test for B. coli.

HISTORY. Advances in Water Purification During Sixty Years, J. W. Ellms. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 666–669 and 760. Condensed history of progress; germ theory and water purification; experiments in rapid-sand filtration; sand problems; iron removal and water softening; new ideas in filter design; reduction in water-borne diseases.

IRON REMOVAL. Removal of Iron and Manganese, R. S. Weston. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 715–716, and 719–720. Removal of iron and manganese from water by aeration and filtration, quick-lime without aeration, storage and contact action; system used at Reading, Mass.; results of operation of Amesbury deferrization plant; effects of organic matter on removal; use of special manganese zeolite; use of pyrolusite.

PLANTS, HAMMOND, IND. New Treatment Plant at Hammond, P. Hansen. *Water Works Eng.*, vol. 90, no. 12, June 9, 1937, pp. 820–825. Description of new 30 mgd plant at Hammond, Ind., to purify most polluted water along Great Lakes; improved sewage disposal; return flow sedimentation; side gutters; coagulants; wash water economies; low-lift pumping equipment; taste and odor removal; operating data; activated carbon experience; chemicals used and their cost; independent water financing.

PLANTS, SANTA BARBARA, CALIF. Santa Barbara's New 8-mgd Water Treatment Plant, A. F. Barnard. *Western Construction News*, vol. 12, no. 7, July 1937, pp. 278–280. Description of new 8-mgd plant at Santa Barbara, Calif., in which water of 28-gr. hardness is softened with alum, lime, and soda ash; new type of filter controls; plant costs $28,000 per mg.

SOFTENING. Small Softening Plants, C. P. Hoover. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 735–736, and 739–740. Present-day practice in design of lime, soda ash, and zeolite softening plants for small community; secondary recarbonation tank; carbonating equipment; over-capacity plants; typical small zeolite plant to remove both iron and hardness; gravity vs. pressure filters; synthetic zeolite.

WATER WORKS ENGINEERING

EMERGENCY OPERATION. Emergencies May Come When Least Expected, L. S. Vance. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 699–700 and 703. Review of measures for meeting any unusual happening which may disrupt service; portable electric plant for lights and valve operation; military radio sets used in flood; handling consumers' frost troubles; electric-gate operating mechanism of Louisville Water Company.

LAWS AND LEGISLATION, POLLUTION. When Pollution Causes Sickness, L. T. Parker. *Mun. Sanitation*, vol. 8, no. 7, July 1937, pp. 373–374. Review of recent court decisions with respect to responsibility of municipalities for purity of its water supply.

METERING. Metering—Its Growth and Effect, W. W. Brush. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 723–724 and 727. Development of practice of selling water by volume in United States; effect of metering Milwaukee (Wis.) system; Buffalo and Milwaukee water works compared as to benefits derived from universal meterage.

WASTE SURVEYS. Buffalo's Water Waste Problem and Its Solution, L. S. Spire. *Pub. Works*, vol. 68, no. 6, June 1937, pp. 9–11. Statistical study of per capita consumption of water in Buffalo, N.Y., during period 1904–1937; effect of pitometer survey; effect of business depression on pumpage; coal savings.

WELLS, NEW YORK CITY. Record of Wells in Kings County, N.Y. *N.Y. Dept. Conservation—Water Power & Control Commission—Bul. GW-3*, 1937, 175 pp., supp. map. Records of about 500 wells in and near Brooklyn, N.Y.; well logs and descriptive notes; index of wells by streets; index of wells by owners.

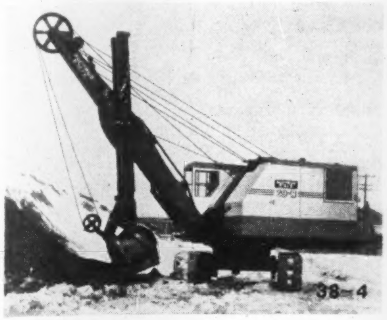
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

New 1-Yard Excavator

Another modern power shovel, convertible to dragline, clamshell, crane, or dragshovel, is announced by the Bucyrus-Erie Company, South Milwaukee, Wis.

This new speedlined machine, known as the 29-B, is equipped with Bucyrus-Erie speed-type cast V-front, welded dipper—strong, light, easy filling, quick dumping. The inserted teeth are of long-wearing, forged tool steel, quickly reversed, resharpened, or replaced. Reinforcing diaphragms are welded into the light, all-welded boom. Strong, wide-spaced, outside handles hold the dipper firmly into digging. Extra large boom-point sheaves, 36 in. diameter, contribute to good digging angles and unusually long rope wear. Single shaft drive cats give powerful traction, facilitating easy climbing with quick, accurate steering, and allowing short or gradual turns. Swing gears and transmission boom-hoist and propel are enclosed and run in oil. All high-speed shafts operate on ball or roller bearings. A fast, worm-drive boom-hoist is standard equipment, but a special independent high-speed power up and power down live boom-hoist is available. Gasoline, Diesel, or electric power is delivered through a straight-line transmission with gears enclosed and running in oil. Bulletin FBE 29B1 may be obtained from the manufacturer.



New Centrifugal Pumps

Goulds Pumps, Inc., Seneca Falls, N.Y., announces a complete new line of single stage, side suction, ball bearing centrifugal pumps. There are eighteen sizes with capacities from 5 to 1800 g.p.m. against heads up to 110 ft for flat or V-belt or direct motor drive. Modern hydraulic design is embodied in casings, impellers, and stuffing boxes. Structural strength, amply proportioned parts, high quality materials, outstanding performance, trouble-free service and long life are the features claimed by the manufacturer. Bulletin No. 210 gives complete details, data tables and all needed information.

High Speed Electric Concrete Vibrator

The Syntron Company, of 555 Lexington Ave., Homer City, Penna., have just put on the market a new electric motor-driven, internal type of concrete vibrator.

The equipment consists of three pieces—an electric drive motor mounted on two small wheels, a variable length of flexible shafting, and the vibrating tool. The motor is of the repulsion-induction type and operates on both 110–220 volts, single phase, A.C. It has a built-in gear box with quiet, molded gears, that increases the driving speed to 7200 RPM.

The metal-armored, flexible shafts are available in 7 ft and 12 ft lengths that can be coupled together to make up to a maximum length of 31 ft. The vibrating tool is available in two sizes—$1^{5}/_{8}$ in. and $2^{5}/_{8}$ in. diameter. Complete catalog information may be obtained from the manufacturer.

Technical Bulletins on Cantilever Walls

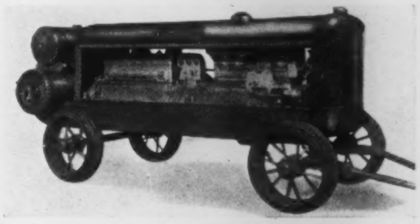
Carnegie-Illinois Steel Corporation, Carnegie Building, Pittsburgh, Penna., has just issued a 32-page technical bulletin entitled, "Steel H-Beams and Steel Sheet Piling Used as Cantilevers in Soil." This bulletin offers suggested methods for the determination of the length and bending moment for Steel H-Piles and Steel Sheet Piling driven into soil. It should prove of special interest to engineers concerned with the construction of cantilever walls, or the determination of lateral resistance value of piles driven in soil.

Copies of the bulletin may be obtained from the General Offices of Carnegie-Illinois Steel Corporation in Pittsburgh, or from any District Office.

Schramm "Utility" Compressor

The Model 315 Schramm "Utility" Compressor represents a complete line of sizes from 105 to 420 cu ft.

A weight reduction of 5,000 to 6,000 is claimed for this model over former types, accomplished by embodying the modern engineering principles of their "Utility" compressor design, as well as the application of the Buda Lanova Diesel engine with its high speed operation. Compressor features include mechanical, cam operated intake valves, seven main bearings, force feed lubrication in both engine and compressor and electric self-starting. Complete information about the Model 315, as well as other items of the line, is contained in bulletin 3700-A-CG. Schramm, Inc., West Chester, Penna.



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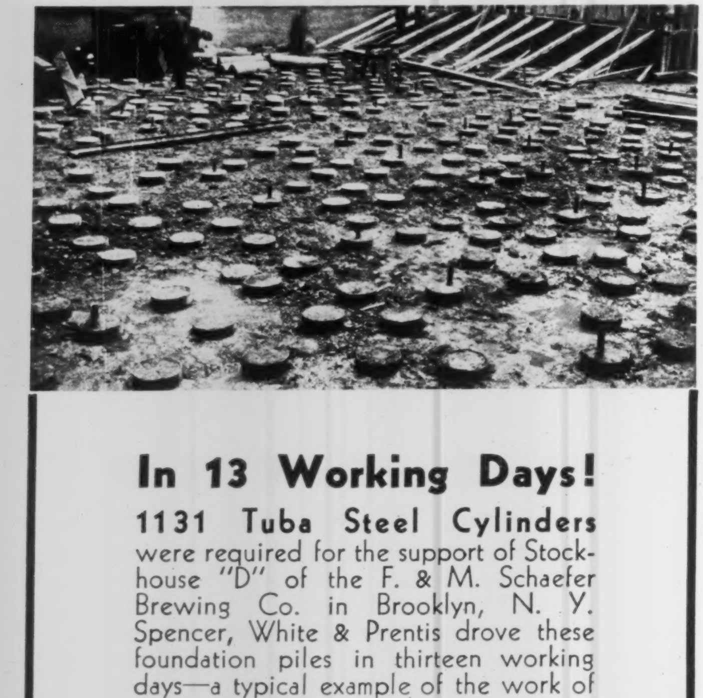

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BRIDGES

Concrete Construction. Some Notes on Gunite and Its Uses on Certain Works on North Western Railway, S. L. Kumar. *Punjab Eng. Congress—Proc.*, vol. 25, 1937 (Paper no. 203), pp. 91–105, (discussion) 105a–105g supp. plates. Advantages of guniting over plastering; guniting of new bracings of pile bents of Chinna Creek Bridge at Karachi; guniting certain piers of girder bridge between Rohri and Khanpur.

Construction, Falsework. High Timber Falsework Units. *Eng. News-Rec.*, vol. 120, no. 1, Jan. 6, 1938, pp. 20–21. Description of timber falsework towers, built of preassembled frames, used in erection of Golden Gate Bridge approaches; arrangement of falsework and derricks for steel erection of 320-ft arches combined with bents to provide lateral stability.

Piers, Construction. Deep Piers for Baton Rouge Bridge. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1938, pp. 106–108. Features of piers for combined highway and railway bridge over Mississippi, at Baton Rouge, La., to reach depth of 180 ft below low-water level; concrete piles for substructure of east approach; progress to date.

Railroad Crossings. Overpass on Rigid Frame Bents. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1937, pp. 111–112. Design of overpass approach to upper deck of I St. Bridge, Sacramento, Calif., featuring frames of various spans to clear railway tracks; hip joint detail of rolled-section rigid frames in which web is cut and flanges bent to curve.

Railroad Crossing, Elimination. Less Expensive Plan Presents Better Appearance. *Ry. Age*, vol. 104, no. 6, Feb. 5, 1938, pp. 260–261 and 266. Article deals with esthetic considerations which influenced design of grade-separation structure recently built to carry track of Toledo Terminal over highway in Toledo, Ohio.

Reconstruction. Raising of Jhelum Bridge, T. McIntyre. *Punjab Eng. Congress—Proc.*, vol. 25, 1937, (Paper no. 199), pp. 41–45, (discussion) 45a–45b, supp. plates. Methods employed in raising all spans of railway bridge and road bridge 4 ft, by raising girders and inserting steel grillages under bearings on top of piers; cost data.

Rigid Frame, Hawaiian Islands. Hawaii Builds Long Rigid Frame, W. R. Bartels. *Eng. News-Rec.*, vol. 120, no. 4, Jan. 27, 1938, pp. 155–156. Design and construction of Wahiawa Gulch Bridge on island of Kauai, having concrete rigid frame with main span of 125 ft, total length 182 ft; details of cantilever side spans, curved retaining walls, flanged ribs, and architectural curtain walls.

Steel Arch, Failure. Record Ice Jam at Niagara Falls Wrecks Famous Arch Bridge. *Eng. News-Rec.*, vol. 120, no. 5, Feb. 3, 1938, pp. 161 and 168–169. Description of failure of 840-ft, 2-ribbed, steel-arch span of Falls View Bridge, at Niagara Falls, pushed off its foundation by ice flow; discussion of nature and causes of failure.

Steel, Germany. Staehlerne Autobahnbruecken bei Kassel, W. Bachmann. *Bauingenieur*, vol. 18, nos. 23/24, 25/26, and 27/28, June 18, 1937, pp. 350–356; June 24, pp. 382–388; and July 9, pp. 415–418. Design and construction of several steel viaducts and highway bridges at Kassel, Germany; design and construction of Tiefenbach twin viaduct comprising 3 spans, 24 to 32 m in length.

Steel, Parker, Ariz. Armored Steel Trestle. *Eng. News-Rec.*, vol. 119, no. 25, Dec. 16, 1937, pp. 985–987. Design and construction of new trestle-type highway bridge over Colorado River at Parker, Ariz., consisting of ten 63-ft spans; bridge is supported on pile bents in each of which are 8 steel piles consisting of 12-in., 74-lb H-columns; pile forms; cost, including bulkheads and riprap, was about $115,000.

Steel Truss, Reconstruction. Reconstruction of Inchcape Bridge, Bengal and North Western Railway, D. W. Ravenhill and G. Wilson. *Instn. Civ. Engrs.—J.*, no. 1, November 1937, pp. 49–56, supp. plates. Reconstruction of two of eighteen 200-ft girder spans of Inchcape Bridge, Bengal, which was overthrown by earthquake of 1934; details of make-up of rebuilt spans; results of tests.

Steel Truss, Soviet Union. Les Ponts de Gorkii et de Saratow, sur la Volga (Russie), P. Kandaouroff and K. Pohl. *Génie Civil*, vol. 111, no. 2882, Nov. 6, 1937, pp. 392–395. Description of new steel-truss bridge over Volga River, at Gorky, U.S.S.R., consisting of 2 spans, 160 m each, and 2 spans, 65 m each, also approach consisting of concrete arch spans, 55 m each, totaling 666 m in length; description of new steel truss bridge over Volga River at Saratov, 1,720 m total length, with maximum spans up to 193.5 m.

Vibrations. Energy Dissipation in Vibrations of Bridge, K. Sezawa and K. Kanai. *Tokyo Imperial Univ.—Earthquake Research Inst.—Bul.*, vol. 15, pts. 2 and 3, June 1937, pp. 385–392, and Sept., pp. 590–596. Theoretical mathematical analysis of conditions attending dissipation of vibrational energy of bridge span into its piers and adjacent spans; numerical example. (In English with brief Japanese abstracts, pp. 392–393 and 597.)

BUILDINGS

Exhibition Buildings, San Francisco. Steel Roof Support Has 300-Ft. Span. *Eng. News-Rec.*, vol. 120, no. 5, Feb. 3, 1938, pp. 173–175. Design and construction of steel frame roof supporting structure of livestock exhibition building in San Francisco, Calif., occupying area of 300 by 400 ft; very flat, 3-hinged roof arches set on steel cantilever arms anchored in stadium concrete resulting in span of nearly 300 ft; concrete foundations and details of stadium structure; design requirements.

Explosions; New London, Tex. Explosion in School Building at New London, Tex., March 18, 1937, D. J. Parker, G. W. Jones, H. B. Hill, and G. Wade. *U. S. Bur. Mines—Report Investigations*, no. 3365, December 1937, 29 pp., supp. plates. Construction of building; details of explosion and its effects; conclusion is that immediate cause of disaster was ignition and resulting explosion of large volume of natural gas air mixture accumulated in inadequately ventilated space beneath first floor of main school building; recommendations to avert similar tragedies in the future.

Hospitals, Great Britain. New Westminster Hospital, R. T. Morgan. *Structural Engr.*, vol. 15, no. 12, Dec. 1937, pp. 486–501. Structural features of new 8-story and 9-story buildings of Westminster Hospital, London, occupying area of 103,000 sq ft; details of concrete retaining walls, foundations, and floor slabs. Before Instn. Structural Engrs. & Instn. Civ. Engrs.

Modern. Buildings That Express New Trends. *Eng. News-Rec.*, vol. 119, no. 24, Dec. 9, 1937, pp. 925–960. Special issue of magazine containing symposium of following articles: Introduction, W. G. Bowman; Twenty-Seven Forms of Glass; Masonry Gives Way to Steel; More Light, More Space, More Efficiency; School Without Windows; Parking on Roof; Getting Ready for Bigger Airplanes; Concrete Improves Its Appearance; Seen and Heard on Building Jobs; Welded Rigid Frames for Roofs; Moving to Country; Office Building Without Precedent.

Steam Heating, Apartment Houses. Heating Problems of Large Slum Housing Projects, F. H. Valentine. *Heating & Vent.*, vol. 34, no. 12, December 1937, pp. 29–32. Heating system installed in Cedar-Central Apartments in Cleveland, which were erected recently by PWA; points out major features of installation and gives recommendations for future installations based on author's experiences and observations gained in connection with supervising installation of mechanical work in this project.

Welded Steel. Armco's Research Laboratory. *Welding J. (N.Y.)*, vol. 17, no. 1, Jan. 1938, pp. 40–42. Detail of welded structure; building has frontage of 255 ft and depth of 175 ft, providing 43,500 sq ft of floor space; it is saw-tooth type with welded steel frame construction of new design; no rivets driven in structure.

CONCRETE

Admixtures. Classification of Admixtures as to Pozzolanic Effect by Means of Compressive Strength of Concrete, F. R. McMillan and T. C. Powers. *Am. Concrete Inst.—J.*, vol. 9, no. 2, Nov.–Dec. 1937, pp. 129–143. Experimental study of effect of admixtures on compressive strength at constant cement content; effect of precipitator ash and hydraulic lime; age-strength relationships; strength as index to pozzolanic action; comparison of mixes containing admixtures with plain mixtures.

Floors. Moments in Flat Slabs, P. G. Bowie. *Structural Engr.*, vol. 16, no. 1, Jan. 1938, pp 2–13. Outline of author's original empirical method of design of flat reinforced concrete slabs supported directly on columns; effect of column cap; degree of fixation; bending in columns; concentrated loads. Before Instn. Structural Engrs.

Railroad Maintenance of Way. Strengthening of Roadbed on Clay Formation for Main Line Traffic. *Ry. Gaz*, vol. 67, no. 23, Dec. 3, 1937, pp. 982–984. Details of strengthening of roadbed of Southern Railway main line between London and Dover; roadbed is covered with layer of powdered rock; on this, precast concrete slabs are placed, and superimposed on these, four scrap rails are laid longitudinally; whole is covered with more powdered rock covering rails; layer of fine ashes placed on top of this and track replaced.

Shrinkage. Ueber die Ursache der Haftung des Betons am Eisen in Eisenbeton-Konstruktionen, V. Karpen. *Zement*, vol. 26, no. 19, May 13, 1937, pp. 316–317. Cause of adhesion of concrete to iron in reinforced concrete construction; results of investigations prompted by collapse of reinforced concrete ceilings in Bucharest, Roumania, 20 years ago; author concludes this is due to shrinkage of concrete from iron. See also discussion by K. Wuerzner in no. 24, June 17, 1937, issue of same journal.

CONSTRUCTION INDUSTRY

Equipment. Planning and Plant for Heavy Construction—18, A. J. Ackerman and C. H. Locher. *Construction Methods & Equipment*, vol. 19, no. 6, June 1937, pp. 66–70. Principles and practices of job layout and selection and use of equipment; special foundations grouting, piling, and caissons; grout curtain under Norris Dam; clay grouting; asphalt grouting; Francois cementation processes; freezing of earth; core walls; special foundations of piling; open shafts for large piers.

DAMS

Boulder Dam. Boulder Dam, J. L. Savage. *Instn. Civ. Engrs.—J.*, no. 7, June 1937, pp. 161–180, 2 supp. plates. Special lecture for British Institution of Civil Engineers by designer of Boulder Dam, reviewing history, construction, equipment, and methods; also main features of project, such as diversion tunnels, spillways, dam, intake towers, penstocks, and outlet conduits and power plant.

Buttress. Buttressed Dams: Modern Development, J. W. Lewis. *Indian Eng.*, vol. 102, no. 2, Aug. 1937, pp. 57–59. Features of Ambursen system of construction; constructive comparisons; recent developments; recent erections.

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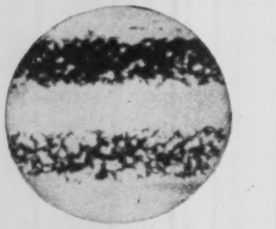

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Concrete Gravity. Twist Effects in Straight Gravity Dams, I. E. Houk. *Engineer*, vol. 164, nos. 4275 and 4276, Dec. 17, 1937, pp. 676–678 and 686, and Dec. 24, pp. 702–705. Important effects of twist action on stresses, sliding factors, and shear friction factors of safety in straight gravity dams, summarized; shear friction factors, sliding factors, and stresses; analysis of twist action; twist action in Grand Coulee Dam; relieving twist action.

Concrete Gravity, Construction. Cableway Handles Concrete at Pickwick Landing Dam. *Construction Methods & Equipment*, vol. 19, no. 5, May 1937, pp. 52–53. Design and operation of fixed 12-ton cableway, 1,270 ft long, to transfer concrete from central mixing plant to working areas in cofferdams for second and third construction stages of Tennessee Valley Authority Pickwick Landing Dam; concrete placing by gantry cranes.

Concrete Gravity, Temperature Measurement. Measured and Computed Temperatures of Concrete at Norris Dam, D. McHenry. *Am. Concrete Inst.—J.*, vol. 9, no. 2, Nov.–Dec. 1937, pp. 117–125. Comparative study of observed temperatures and temperatures computed by various methods; temperature history of point in interior of large block; temperature distribution through upstream half of large block.

Dredges, Suction. Dredging Installation with Long Pipe Lines, V. M. Kerichev. *Sudostroyeniye*, no. 5, May 1937, pp. 74–76. Removal of silt from reservoirs in U.S.S.R. by means of suction dredge operating through pipe lines 2,200 m long.

Earth, Colorado. Ralston Creek Dam, C. H. C. Braden. *Explosives Engr.*, vol. 16, no. 1, Jan. 1938, pp. 13–19. Construction of Ralston Creek earth-fill dam in central Colorado, 200 ft maximum height; volume of earth-fill 2,500,000 cu yd plus 158,000 cu yd of rock facing on both sides of dam.

Earth, Grouting. Grouting Under Earth Dam. *Eng. News.-Rec.*, vol. 120, no. 1, Jan. 6, 1938, pp. 15–20. Methods of connecting bottom of sheet piles to rock by concrete, providing elaborate drainage system over porous foundation to permit placing earth-fill in dry, and later grouting this drainage system, followed in constructing foundation of Pine View Dam, east of Ogden, Utah; sand boils and springs; drain and grout systems; grouting spring area.

Earth, Seepage. Seepage Through Dams, A. Casagrande. *New England Water Works Assn.*, vol. 51, no. 2, June 1937, pp. 131–172. Theoretical mathematical discussion of seepage through earth-fill dams; also results of laboratory tests; Darcy's law for flow of water through soils; Forchheimer's graphical solution; seepage through homogeneous isotropic earth dams; seepage through anisotropic soils; design of earth dams and levees; comparison between Forchheimer's graphical method, hydraulic model tests, and electric-analogy method; 2 appendixes. Bibliography.

Foundations. Talsperren-Gruendungen in Eruptivgesteinen, P. Ziegler. *Bauingenieur*, vol. 18, no. 25/26, June 24, 1937, pp. 369–373. Design of dam foundations on eruptive formations; examples from recent German practice.

Parks, Reservoirs. Recreation Dam Built in Miami Reservoir, C. H. Eiffert. *Eng. News-Rec.*, vol. 120, no. 4, Jan. 27, 1937, pp. 137–139. Design and construction of low concrete dam, submerged in time of flood by backwater from flood-control dam, creating attractive ponds in Englewood Reserve of Miami Conservancy District, near Dayton, Ohio.

Siphon Spillways. Siphon Spillway, K. D. Joshi. *Indian Eng.*, vol. 101, no. 4, April 1937, pp. 124–130. Application of theoretical principles to design for high masonry dam Vani Vilas Sagar (Hiriyur Taluq) in India; throat depth; width and number of siphons; shape of siphon beyond crest; level of siphon outlet; downstream vertical leg; siphon priming; inlet cowl; air vents; jet dispersers.

FLOOD CONTROL

Floods, Forecasting. Modernizing Headwater Forecasting, M. M. Bernard. *Eng. News-Rec.*, vol. 119, no. 25, Dec. 16, 1937, pp. 988–990. Report on cooperative work in Pennsylvania for getting better advance warning of unusual floods from sources controlled by several agencies; gathering precipitation data; rain and stream-gage stations in Pennsylvania; low-cost recording gage.

FOUNDATIONS

Earth Pressure. Estimating Earth Pressures, N. M. Newmark. *Eng. News-Rec.*, vol. 120, no. 1, Jan. 6, 1938, pp. 23–24. Theory and construction of simple chart speeding up computation of vertical earth pressures caused by foundation loadings; numerical examples.

Pile Driving. Behavior of Piles in Cohesive Soils, R. V. Allin. *Civ. Eng.* (London), vol. 32, no. 373, July 1937, pp. 251–252. Study of causes of increased resistance to penetration of piles driven, after period of rest, into water-bearing cohesive soils of low permeability such as soft clay, loam, and fine-grained silts.

Piles, Concrete. Piling at Kent Cement Works, C. P. Taylor and B. Buxton. *Concrete & Constructional Eng.*, vol. 32, no. 11, Nov. 1937, pp. 621–632. Effect of use of dollies in driving piles of reinforced concrete, 16 in. square by 50 ft long; modification to ultimate resistance due to use of dolly; set diagram showing effect of dolly; tightening of piles after interval of time; factors of safety; quake of ground; comparative costs.

Piles, Steel. Steel Sheet Piles and Steel Bearing Piles, Agatz. *Structural Engr.*, vol. 15, no. 11, Nov. 1937, pp. 443–465. Review of German practice in use of sheetpiling and bearing piles in foundations, marine and river structures; cross-sectional shapes of sheetpiling and of bearing piles; field of application; driving characteristics in relation to shape of section and nature of ground; anchorage; new designs and researches; future developments. Before Instn. Structural Engrs. & Instn. Civ. Engrs.

Testing. Geophysical Study of Soil Dynamics, R. K. Bernhard. *Am. Inst. Min. & Met. Engrs.—Tech. Publ., no. 834*, Jan. 1938, 21 pp. Outline of new geophysical method of dynamic soil tests with application of artificial vibration excited by centrifugal forces resulting from eccentrically supported rotating masses; results of test indicating that method opens new field for investigating soils, foundations, dams, and structures, especially buildings that must withstand earthquakes.

Testing. Some Apparatus for Specialized Use on Sites of New Foundations, A. Hiley. *Structural Engr.*, vol. 16, no. 1, Jan. 1938, pp. 14–32. Testing procedure followed in application of test piling; features of apparatus adapted for dealing with hammer blows; resistance diagrams; hydraulic buffer to convert hammer blow to uniform force; differential impact gage; ground resistance. Before Instn. Structural Engrs.

Underpinning. Examples of Underpinning of Heavy Structures, W. Muirhead. *Structural Engr.*, vol. 16, no. 2, Feb. 1938, pp. 54–61. General discussion of necessity for underpinning work; procedure to be adopted in operations of underpinning; example of actual work in case of quay wall in tidal river.

HYDRAULIC ENGINEERING

Canals, Design. New Diagram for Design of Channels, A. J. Wynne. *Civ. Eng.* (London), vol. 32, no. 372, July 1937, pp. 266–267. Construction of diagram for quick and accurate determination of dimensions of channels of capacities from 0 to 3,000 cu ft per sec, having 1-to-1 side slopes and value of Kutters n of 0.030; examples.

Research Laboratories, Italy. Guidonia, citta delle ali, A. Silvestri. *Politecnico*, vol. 85, no. 5. May 1937, pp. 153–160. Buildings and equipment of Guidonia Aeronautical Experiment Station, near Rome, Italy, including wind tunnels, experimental towing tanks, cooling towers, etc.

HYDROLOGY AND METEOROLOGY

Earthquakes, California. Earthquake Investigations in California 1934–1935. *U. S. Coast & Geodetic Survey—Special Publ.*, no. 201, 1936, 231 pp., supp. maps and tables, 35 cents. Field Parties and Problems, F. P. Ulrich; Strong-Motion Program and Tiltmeters, N. H. Heck, H. E. McComb, and F. P. Ulrich; Analysis of Records, F. Neumann; Questionnaire Program for Collecting Earthquake Data, P. Byerly and H. Dyk; Vibration Observations, D. S. Carder; Vibration Studies, R. S. McLean and W. W. Moore; Building and Ground Vibrator, J. A. Blume; Report on Earthquake Damage to Type III Buildings in Long Beach, R. R. Martel; Periods of Ground in Southern California Earthquakes, B. Gutenberg; Preliminary Report on Four-Unit Portable Seismograph, H. Benioff; Geodetic Work in Earthquake Regions in California, W. F. Reynolds and H. S. Rappleye.

Floods, California. Flood in La Canada Valley California January 1, 1934, H. C. Troxell and J. Q. Peterson. *U. S. Geol. Survey—Water-Supply Paper 796-C*, 1937, pp. 53–98, supp. plates 20 cents. Report on catastrophic flood in small valley near Los Angeles, Calif., characterized by maximum discharge of about 500 cu ft per sec per sq mile, and movement of 600,000 cu yd of debris from mountain area to foothill region and valley floor.

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Rainfall and Run-off. Estimation of Run-off from Areas Subjected to Rainstorms, J. R. Daymond. *Instn. Civ. Engrs.—J.*, no. 7, June 1937, pp. 268–271. Abstract of paper discussing

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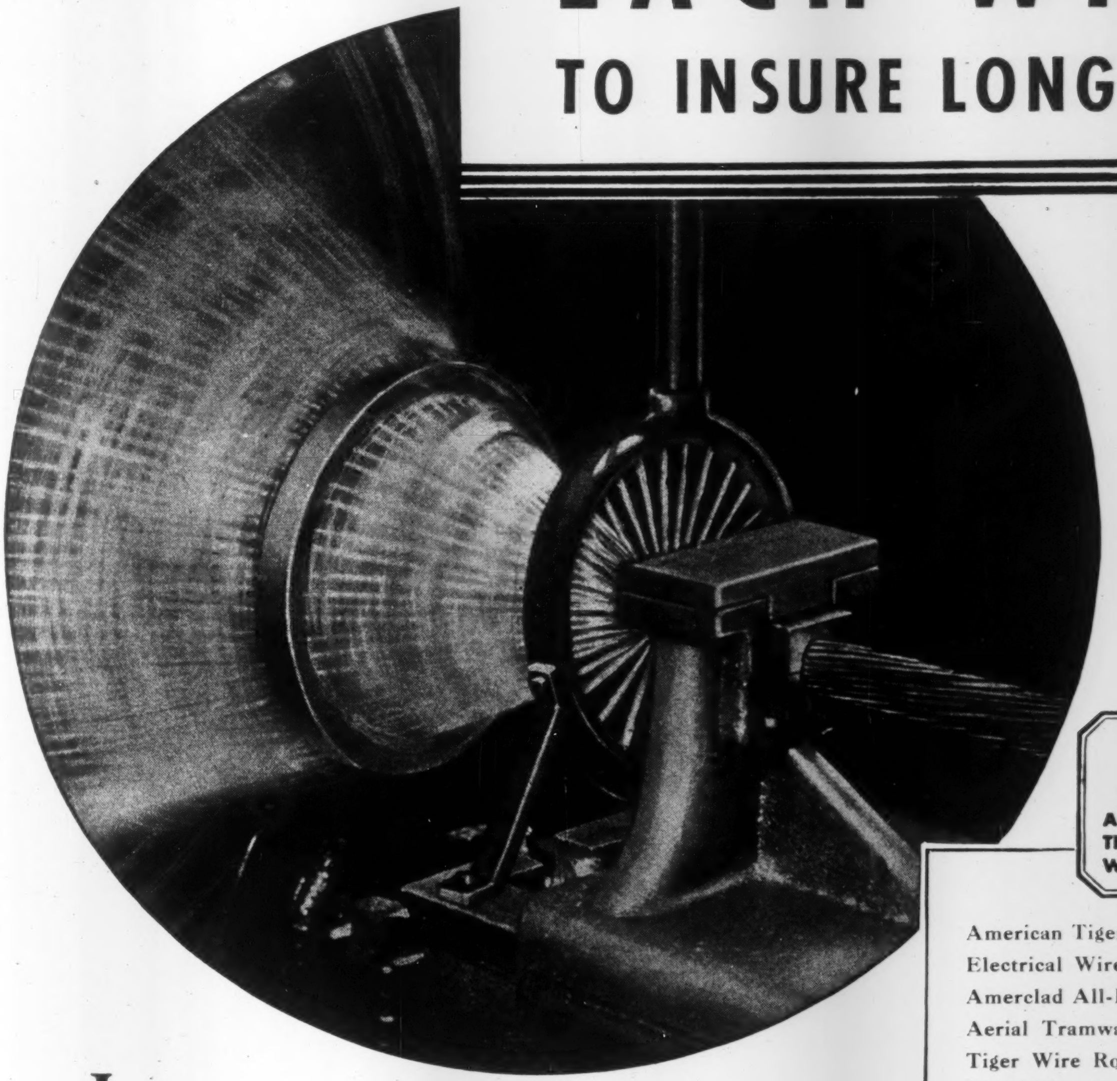

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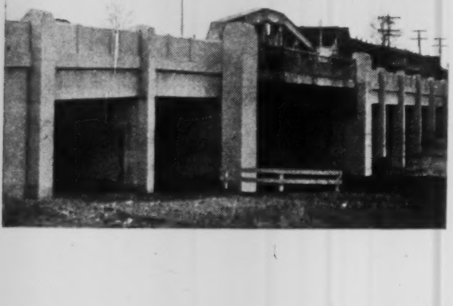

relationship between rainfall and run-off based on law first proposed by Kuichling; general formula for maximum run-off of given area.

Run-off. Impervious Factors, F. V. Appleby. *Instn. Mun. & County Engrs.—J.*, vol. 63, no. 16, Feb. 2, 1937, pp. 1077–1095, (discussion) 1095–1100. Theoretical analysis of run-off during reception and redistribution of run-off on ground surfaces; factors of imperviousness; analysis of experimental evidence; permeability constant; effect of entrance time; inlet flow curves.

Soils, Erosion. Problems of Soil Erosion, E. S. Clayton. *Commonwealth Engr.*, vol. 24, no. 10, May 1, 1937; pp. 327–333. Review of work of U. S. Soil Conservation Service; problem in Australia; methods of checking water erosion; erosion by rivers; structures for gully control.

INLAND WATERWAYS

Germany. Die Arbeiten der Reichswasserstrassenverwaltung im Jahre 1936, Gaehrs. *Bautechnik*, vol. 15, nos. 17, 19, 22, 25, and 31, Apr. 16, 1937, pp. 216–219; Apr. 30, pp. 240–244; May 21, pp. 285–288; June 11, pp. 324–327; and July 16, pp. 412–414. Review of hydraulic construction along Elbe River and Mittelland ship canal; canalization of middle stretch of Weser River and construction of Dortmund-Ems canal; recent waterway improvements in Rhine River watershed, with special reference to connection between Rhine, Main, and Danube rivers; features of new roller dams; canalization of Neckar River.

Rivers, Hydraulics. Problem of River-Bores, Masse. *Permanent Int. Assn. Navigation Congresses—Bul.*, vol. 12, no. 23, Jan. 1937, pp. 59–68. Historical review of theory of bores, or standing waves, in rivers, describing aspects of phenomenon and attempting explanation.

Rivers, Improvement. River Improvement Works, J. W. Lewis. *Indian Eng.*, vol. 101, no. 6, June 1937, pp. 197–199 and 201. Review of modern American and European dredging and excavating equipment.

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IRRIGATION

Algeria. Les Grands Travaux D'Irrigation du Niger, Bauzil. *Annales des Ponts et Chaussées*, vol. 107, no. 9, Sept. 1937, pp. 281–391. Description of new important irrigation projects in French territory in Niger River basin, including construction of dams, regulators, and canals; agricultural developments of irrigated lands including introduction of cotton and rice cultures; colonization of irrigated areas.

California. Progress on Central Valley Project. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1938, pp. 109–110. Progress report on construction of first four miles of Contra Costa Canal; Contra Costa pumps; San Joaquin pumping plants; progress at Friant Dam site.

Canals, Indo-China. Mixed Canals of Lower Cochin China, H. Maux. *Permanent Int. Assn. Navigation Congresses—Bul.*, vol. 12, no. 23, Jan. 1937, pp. 69–75 supp. plate. Description of large network of mixed canals in Mekong River delta, used for navigation and irrigation.

LAND RECLAMATION AND DRAINAGE

Erosion, Control. Results of Experiments on Hydraulics of Drop Inlets and Their Erosion Control Structures, L. H. Kessler. *Agric. Eng.*, vol. 18, no. 6, June 1937, pp. 253–258. Report on University of Wisconsin hydraulic model tests for purpose of developing spillways and outlet designs for erosion control structures, to give optimum hydraulic and economic results; hydraulic tables and charts for selection of size and type of spillway structure. Before Am. Soc. Agric. Engrs.

Landslides, Control. Sistemazione di Frane Lungo Le Strade Alpine, A. Andreocci. *Strade*, vol. 19, no. 6, June 1937, pp. 311–321. Discussion of practice developed for control and prevention of landslides along Alpine highways of Italy; examples of retaining walls and drainage facilities.

Silt, Bibliography. Selected Bibliography on Erosion and Silt Movement, G. R. Williams and others. *U. S. Geol. Survey—Water-Supply Paper* 797, 1937, 86 pp., 15 cents. Annotated international bibliography covering period of 1753 to 1936, inclusive; also number of abstracts of period 1900 to 1936, inclusive; list of publications; vocabularies on soil erosion, silt, and related subjects.

MATERIALS TESTING

Concrete Testing, Porosity. Versuche und Erlaeuterungen zu den Richtlinien fuer die Pruefung von Beton auf Wasserundurchlaessigkeit, O. Graf and K. Walz. *Bautechnik*, vol. 15, nos. 25, 29, and 32, June 11, 1937, pp. 321–324; July 2, pp. 388–391, and July 23, pp. 424–427. Report on German tests of waterproof quality of concrete slabs with variously treated surfaces; details of special equipment developed; testing water-tightness of concretes; water-tightness of concrete as function of time.

PORTS AND MARITIME STRUCTURFS

Caissons, Concrete. Sinking Monoliths and Caissons in Compressed Air, R. S. Cogdon. *Civ. Eng.* (London), vol. 32, no. 373, July 1937, pp. 253-255. Advantages and disadvantages of building heavy concrete quay walls in deep-water berths by sinking monoliths or caissons in compressed air; forms of monoliths or caissons; types of monoliths used recently in construction of deep-water quay; early rectification of faults; filling with concrete.

Danzig and Gdynia. Danzig and Gdynia (Gdingen) im Zeichen schriffahrtshafen-und Schiffbautechnischer Zusammenarbeit, R. Schmidt. *Schiffbau*, vol. 38, nos. 11 and 15, June 1, 1937, pp. 173–178, and Aug. 1, pp. 244–248. Possibility of cooperation between Free Port of Danzig and Gdynia, Poland, with respect to navigation, harbor traffic, and shipbuilding; policies and relations of these two ports discussed; shipping data for both ports compared; illustrated description of new buildings, warehouses, harbor structures, and layout.

Hampton Roads. Port of Hampton Roads Embracing Norfolk, Portsmouth, and Newport News. *Mar. News*, vol. 24, no. 9, Feb. 1938, pp. 43–52. Article deals with port characteristics, features, and facilities.

Jetties, Concrete Block. Concrete Blocks for Jetty Head. *Eng. News-Rec.*, vol. 120, no. 4, Jan. 27, 1938, p. 139. Construction plan for proposed concrete terminal for south jetty head at mouth of Umpqua River on Oregon coast.

Mauritius. Improvements in Harbour of Port Louis, Mauritius, H. C. M. Austen. *Instn. Civ. Engrs.—J.*, no. 1, November 1937, pp. 35–48, supp. plates. Report on recent dredging and reclamation operations of Port Louis, Island of Mauritius, in Indian Ocean; construction of deep-water seawall and grain elevators for storage of rice—capacity 300,000 bags; cost data.

Port Structures, Wave Effect. Solution Rigoureuse du Probleme du Clapotis, Larras. *Annales des Ponts et Chaussèes*, vol. 107, no. 9, Sept. 1937, pp. 392–399. Theoretical mathematical discussion presenting rigorous solution of effect of waves on breakwaters and similar structures.

ROADS AND STREETS

Accident Prevention. Operating County Roads for Safety, L. C. Smith. *Eng. News-Rec.*, vol. 119, no. 25, Dec. 16, 1937, pp. 981–983. Management of highway system of Wayne County, Michigan, for safe operation by design, upkeep, marking, and signaling; organization; traffic lines.

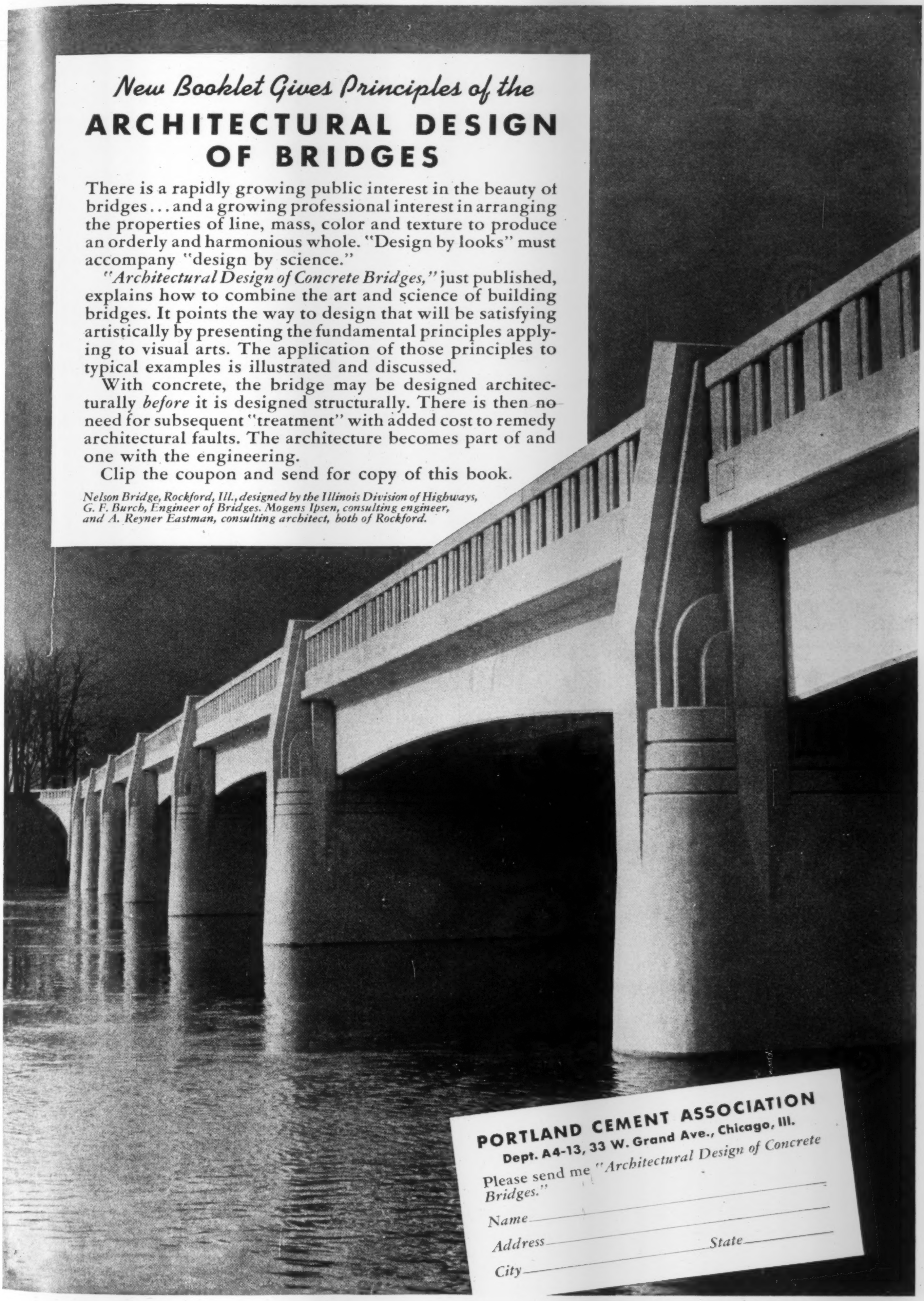
Brick, Paving. New Test Data on Paving Brick. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1938, pp. 119–120. Proceedings of 1938 annual meeting of National Paving Brick Assn., including abstracts of papers and discussions on Association research, bedding course study; Lincoln tunnel tests; chipping and breaking of brick.

Design. Design and Layout of Roads and Junctions, H. P. Tame. *Engineer*, vol. 164, no. 4272, Nov. 26, 1937, pp. 597–598. Discussion of design with special reference to safety; author feels that logical sequence of works is to construct dual carriageways for all traffic on existing trunk roads, simultaneously providing cycle tracks and bypasses where necessary, two additional tracks for speeds of 100 miles per hour being provided as expeditiously as possible. Before Pub. Works Road & Transport Congress.

Erosion Control. Experimental Erosion Control on Forest Highway Fills. *Pub. Roads*, vol. 18, no. 9, Nov. 1937, pp. 176–182. Results of California experimental study of practical methods of preventing erosion and encouraging revegetation on newly constructed fills slopes under varying soil and climatic conditions; willow cuttings; costs of work; failure of brush wattles caused by slippage of surface material.

Pile Driving. Pile Driving in Debris Fill. *Eng. News-Rec.*, vol. 119, no. 27, Dec. 30, 1937, pp. 1045–1049. Development of new driving machines and methods in building steel-pipe pile substructure of New York's express highways; 637,483 ft of piles were driven; fitting pile-driving operations into traffic in downtown New York; kinds and footages of piles driven; organization methods.

Highway Systems. Highways for Transport,



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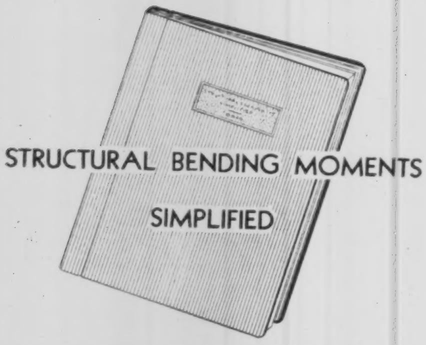

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J. C. Hailer. *Inst. Transport—J.*, vol. 19, no. 3, Jan. 1938, pp. 108–111. Development of modern highway and its traffic conditions; analysis of traffic conditions; most modern standards of highway design.

RAILROAD-ACCIDENT PREVENTION. Modernizing Railroad Grade-Crossing Protection, G. W. Barton. *Roads & Streets*, vol. 80, no. 7, July 1937, pp. 72, 74, and 76. Increasing seriousness of railroad grade-crossing problems in United States; railroad motor-vehicle accidents in United States, 1935; operating crossing signals; flexibility of control possible by using same single-time element relay with different lengths of track circuits; educating motorist. Before Inst. Traffic Engrs.

STABILIZATION. Salt in Relation to Highway Construction and Maintenance, C. A. Robbins. *Can. Engr.*, vol. 73, no. 4, July 27, 1937, pp. 5–7. Developments in stabilizing of gravel roads; selection of materials for salt-stabilized roads; construction procedure; winter road maintenance.

STABILIZATION. Soil Stabilization with Tar, G. E. Martin. *Roads & Streets*, vol. 80, no. 7, July 1937, pp. 47–50. Practical suggestions on use of tar for road stabilization; type and amount of tar; soil concrete; optimum moisture content; preliminary preparation; applying tar; consolidating; traffic-resisting surfaces.

STREET CLEANING. Roads and Public Health, B. H. Knight. *Surveyor*, vol. 92, no. 2373, July 16, 1937, pp. 76–77. Street cleaning as affected by type of road surface; litter problem; trunk roads and public health. Before 1937 Roy. Sanitary Inst. Health Congress.

UNITED STATES. American Highways and Highway Practice, E. E. R. Tratman. *Engineer*, vol. 164, nos. 4265, 4266, 4267, 4268, 4270, 4271, and 4272, Oct. 8, 1937, pp. 394, 397–399; Oct. 15, pp. 416–418; Oct. 22, pp. 440–442; Oct. 29, pp. 468–469; Nov. 12, pp. 524–526; Nov. 19, pp. 554–556; and Nov. 26, pp. 586–587 and 589. Review of developments; in all, there are more than 3,000,000 miles of roads in 1937, of which road systems of several states represent some 523,000 miles; federal aid; function of Bureau of Public Roads; examples of American highway construction.

SEWERAGE AND SEWAGE DISPOSAL

PLANTS, OPERATION. How, When, and Why of Sewage Plant Operation, W. H. Wisely. *Mun. Sanitation*, vol. 8, nos. 6, 7, 8, and 9, June 1937, pp. 310–312; July, pp. 363–366; August, pp. 407–410; and September, pp. 455–457. June: Principles of general maintenance; operating reports. July: Racks and screens; grit chambers. August: Types of sedimentation units; general operation considerations; usage of tanks. September: Sludge treatment and disposal; operation procedures; sludge dewatering units.

SEWERS, CAST IRON. Modern Cast Iron Sewers, D. W. Johnson. *Mun. Sanitation*, vol. 8, no. 5, May 1937, pp. 265–267. Use of cast-iron pipe in sewer field for pipe galleries and other connections, in and around treatment plant; submarine sewers; vibration problems; carrying capacities; use of cast-iron pipe and fittings in sewage-treatment plants.

WATER POLLUTION. Sewage and Shellfish. *Mun. Sanitation*, vol. 8, no. 6, June 1937, pp. 326–328. Proceedings of 1937 spring meeting of New England Sewage Works Assn., including abstracts of following papers: Wastes Disposal as Related to Shellfish, A. P. Miller; Progress in Controlling Pollution of Rhode Island Waters, W. J. Shea; Sanitation Wastes for Power Production, C. A. Mcguire.

WATER POLLUTION, NEW YORK. What Niagara Frontier Is Doing to Clean Up Its Water Courses, R. D. Bates. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 679 and 691. Health menace of direct pollution of Niagara River and its tributaries relieved through action by various communities; extent of sewage treatment along Niagara frontier; Buffalo sewer authority to cost $15,000,000; Niagara Falls sewage works.

STRUCTURAL ENGINEERING

BEAMS, CONCRETE. Graphical Data for Rectangular Concrete Sections, W. S. Wilson. *Surveyor*, vol. 91, no. 2366, May 28, 1937, pp. 747–748. Construction of graphical charts for design of doubly reinforced concrete beams.

BEAMS, CURVED. Stress Analysis Is Simplified by New Method, K. E. Bisshopp. *Machine Design*, vol. 9, no. 8, August 1937, pp. 40–43 and 86. Equations for evaluating stresses in curved beams presented.

FLOORS, CONCRETE SLAB. New Precast Slab Tile Floor Uses Simple Laying System. *Brick & Clay Rec.*, vol. 91, no. 6, December 1937, pp. 303–304. 15-ft floor stands test of 200 lb per sq ft; slabs fit any plan; cost compares favorably with wood joist system.

ROOFS, CONCRETE SHELL. Thin-Shell Concrete Barrel Roof. *Construction Methods & Equipment*, vol. 19, no. 4, April 1937, pp. 44–47. Design and construction of barrel-vault roofs of Hershey sport arena, at Hershey, Pa., consisting of reinforced concrete shell only 3$^{1}/_{2}$ in. thick, stiffened at intervals of 39 ft by two-hinged arch ribs, spanning 222 ft between hinge centers; hinge details; falsework and forms; screw jacks utilized in controlling settlement of forms during placing of concrete and of stresses in roof shell during decentering.

TUNNELS

SUBWAYS, BELGIUM. Travaux de la Jonction Nord-Midi a Bruxelles, Magnel. *Annales de l'Institut Technique du Batiment et des Travaux Publics*, vol. 2, no. 6, November–December 1937, pp. 32–45. Design and construction of 6-track railroad tunnels joining northern and southern railroad stations in Brussels, Belgium, including railroad tunnel, 2 km long, and two approach viaducts 215 and 892 m long.

VENTILATION. Ventilating Lincoln Vehicular Tunnel, C. W. Murdock. *Heating, Piping & Air Conditioning*, vol. 10, no. 1, Jan. 1938, pp. 61–68. General plan of Lincoln Tunnel, which passes under Hudson River from West 39th St., Manhattan, to New Jersey shore; description of ventilating system; air requirements for ventilation; air measurement apparatus; ventilation buildings; fans and motors; control system; heating. Before Am. Soc. Heating & Vent. Engrs.

WATER TREATMENT

CHLORINATION. Chlorine in Flood Disasters, C. C. Agar. *Mun. Sanitation*, vol. 8, no. 6, June 1937, pp. 321–334. Review of recent New York State experiences; private water supplies; Ohio River experiences; cistern sanitation; general directions for cleaning and disinfecting cisterns; cleaning homes; miscellaneous uses of chlorine.

COLORED AND CORROSIVE WATER. Chemical Treatment of Colored and Corrosive Water at Ottawa, Ont., H. P. Stockwell. *Eng. & Contract Rec.*, vol. 50, no. 69, Apr. 21, 1937, pp. 25–27. Coagulation procedure; coagulants; usefulness of experimental filter; lime treatment; tastes during cold weather.

FEEDWATER TREATMENT, COAGULATION. Coagulation as Applied to Industrial Waters, A. P. Black, R. A. Bardwell, and B. W. Graham. *Am. Water Works Assn.—J.*, vol. 29, no. 10, October 1937, pp. 1533–1547. Discussion of methods for improving quality of industrial water supplies by coagulation; alum and ferric salts as coagulants; floc formation of sodium aluminate; use of sodium zincate as coagulant; silica removal; use of bentonite and titanium salts as coagulants. Bibliography.

FILTRATION PLANTS, MASSACHUSETTS. Construction of Modified Slow Sand-Filtration Plant at Greenfield, Mass., H. L. Field. *New England Water Works Assn.—J.*, vol. 51, no. 2, June 1937, pp. 173–183, (discussion) 183–184. Description and results of operation of plant designed for capacity of 2 mgd and filter rate of 5 mgd per acre, consisting of coagulating basin in two units, each storing 9.6 hours of flow, two filter units, each 0.2 acre in area, filtered water basin storing about 550,000 gal, filter house, piping and appurtenances.

MODERN METHODS. Trends in Water Treatment, N. J. Howard. *Water Works Eng.*, vol. 90, no. 11, May 26, 1937, pp. 728 and 731–732. Survey of present trends toward reducing hardness, neutralization of corrosive factors, and more effective treatment before filtration; abatement of pollution; glassed-in filters at Toronto; silicates improving coagulation; mechanical aids available; aid from manufacturers; making water anti-corrosive; evaluating activated carbons; copper sulfate technique.

WATER WORKS ENGINEERING

CEDAR RAPIDS, IOWA. Plenty of Good Water at Low Cost, W. W. DeBerard. *Eng. News-Rec.*, vol. 119, no. 25, Dec. 16, 1937, pp. 977–980. Description and results of operation of 12-mgd water supply system of Cedar Rapids, Iowa, completed in 1930; metering; meter maintenance and testing; handling complaints; hydrant maps; main valve records; purification system; grounds; financing.

DAYTON, OHIO. Development of Ground Water Supply of City of Dayton, Ohio, W. W. Morehouse. *New England Water Works Assn.—J.*, vol. 51, no. 2, June 1937, pp. 219–226. Historical review of development of underground water supply for present population of 220,000, beginning with 1870.

NEW YORK CITY. Additional Water Supply for City of New York, W. E. Spear. *New England Water Works Assn.—J.*, vol. 51, no. 2, June 1937, pp. 227–231. Brief review of proposed extensions of present water supply of New York City.

OPERATION. Winter and Waterworks, W. W. DeBerard. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1938, pp. 103–105. Review of cold weather precautions practiced in operation of water works of Eau Claire, Wis., where frosts penetrate to 7 ft; hydrant leakage tests; emergency provision against outages in supply of electricity to well field.

STABILIZE YOUR ROADS FROM THE FOUNDATION UP

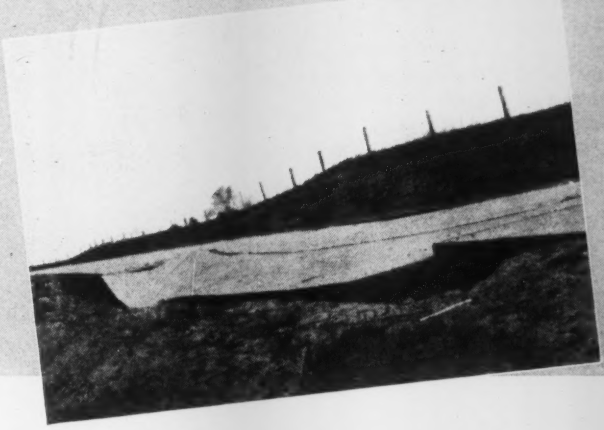
to prevent

Saturated subgrades and the change that takes place in their supporting power.

Changes in the volume of soils.

SEVERE FROST
DAMAGE
DRIVE
CAREFULLY

Lateral movements of soil and resulting collapse of pavements.



• Science has replaced guesswork in highway design. Now, instead of putting all the money into the surface, more and more attention is rightfully being given to the *subgrade.* For highway engineers have learned from experience that a dry stable subgrade insures a smoother, safer, longer-lasting road surface — at greatly reduced maintenance costs.

But remember, to stabilize the subgrade, you must first *intercept and remove ground water.* To do this effectively for either new construction or maintenance, you need a subdrainage pipe designed for this specific purpose. That's why it's cheaper in the long run to use Armco Perforated Iron Pipe. Write us. Armco Culvert Mfrs. Association, Middletown, O.

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ARMCO PERFORATED PIPE

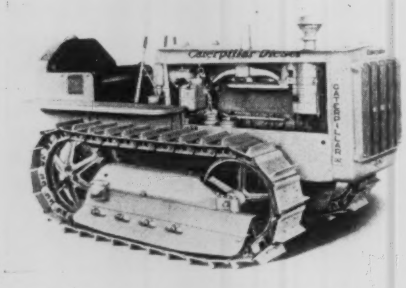
A Product Originated and Developed by Armco Engineers

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Light Diesel Tractor

A smaller track-type Diesel tractor, the Diesel D-2, has been announced by the Caterpillar Tractor Co., Peoria, Illinois. This 25 hp unit is powered with a four-cylinder, four-cycle Diesel engine with five forward speeds.



Designed for use with light blade graders, maintenance machines and scrapers, it is reported to consume only $1^1/_4$ gal of fuel per hour.

Close-Coupled Motor Pump

The Gardner-Denver Company, Quincy, Ill., announces its new close-coupled centrifugal motor pump, designed for capacities up to 250 gal per minute and heads up to 250 ft at speeds of 1,750 and 3,460 rpm. The speed depends upon the required capacity and head. Known as Type H, the new pump meets the requirements of all general pumping service.

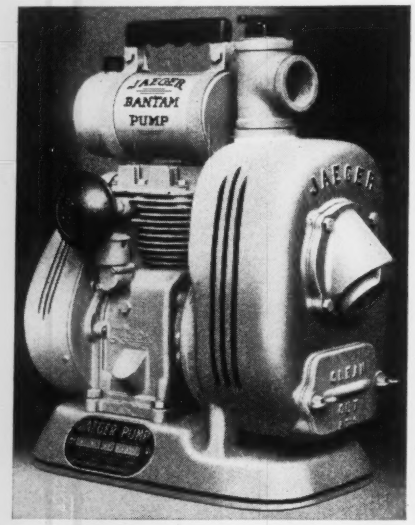
The pump is single suction, having a single stage enclosed impeller made of standard bronze. The pump and splash proof motor are mounted together to form a complete and compact unit. An adjustable bearing in the outboard end of the motor compensates for wear between the clearance spaces in the pump, eliminating the trouble of replacing wearing rings. The pump can be installed in any position; on the floor, wall or ceiling, and either horizontally or vertically.

GARDNER DENVER

Detailed information concerning the Type H close-coupled centrifugal motor pumps is given in Bulletin #A-201.

Light Weight Pump

This automatic priming pump, built of aluminum alloy and weighing only 52 lbs, is being offered by The Jaeger Machine Company, Columbus, O. Its rated capacity of 5,200 gal per hr is said to be the largest ever developed by a pump of this light weight. The priming action, employing the Jaeger patented priming jet, insures fast self-priming at lifts up to 25 ft. Including standard $^3/_4$–1 hp ball bearing engine with carbureter and unusually large gasoline tank of .4 gal capacity, the Bantam measures only $9^1/_2 \times 19$ in., may easily be carried by a boy or shoved into the front or back of any automobile. It is also furnished with $^1/_2$-hp splash-proof electric motor which may be plugged into any light socket.



The low price of the unit is an added feature of this light weight pump.

Non-Skid Flooring

An improved type of non-slip safety metal, called Non-Slip ABSCO Metal, which is highly resistant to rust and acid corrosion and unaffected in its non-slip properties by water, oil, or other slippery liquid substances, is being manufactured by The American Brake Shoe and Foundry Company, New York, N.Y.

Electric furnace abrasive grains, reported to be the best anti-skid material known, are applied to cast iron, bronze, aluminum, or nickel silver, by a special process of casting. The abrasive grains are deeply and uniformly bonded into the metal at the time of casting, thus forming a virtually indestructible bond.

ABSCO metal is extensively used for stair treads, ramps, industrial floors, platforms, elevator door sills, swing type door thresholds, trench covers, etc.

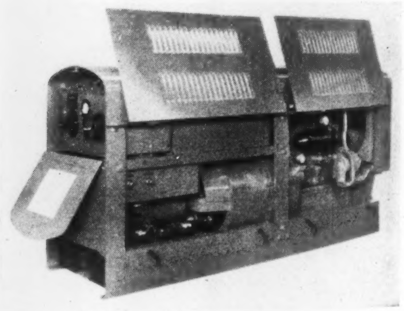
Valves for Many Uses

Three new valves which have uses in almost every industry are being introduced by Crane Co., Chicago. These small 3,000-lb plug type disk, globe and angle valves are called bar stock valves because their bodies and bonnets are made from solid bar stock. They are reported to be ideal for connections on orifice meters, regulator leads, by-passes, gages, for use as expansion valves on ammonia lines and for many similar services where accurate regulation of flow is desired or where instruments must be protected against the sudden release of high pressures.

All of these valves may be packed when wide open under pressure. They are furnished either in steel, Excelloy or 18-8 chrome nickel alloy.

Diesel Driven Welder

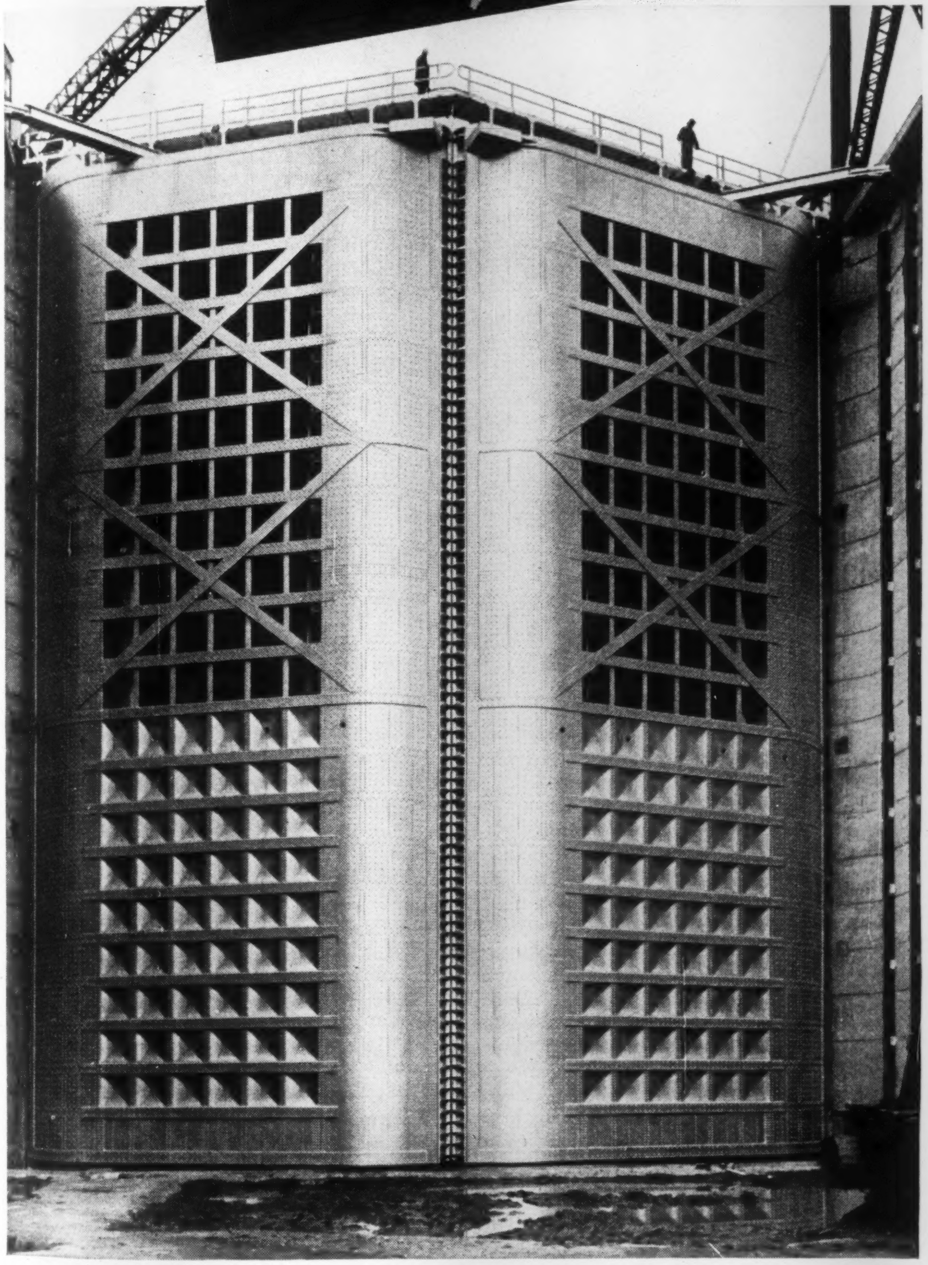
Diesel engine power has been adapted to the driving of arc welding generators by the Lincoln Electric Co., Cleveland, O. The new Diesel engine employed is reported to compare favorably with gasoline engines in simplicity, weight, cost and operating speed, and to reduce fuel costs 33% to 86%, depending upon the price of the fuel oil used. Maximum efficiency and service economy are claimed because of a new Diesel principle embodying patented combustion chambers; pintle type fuel nozzles; five filters; and starting with the main welder generator through standard 6-volt automobile batteries.



The arc welding generator used on the new Diesel engine driven welding machine, is the 300-ampere "Shield-Arc SAE" unit equipped with dual-continuous control. Features of this generator include continuous voltage control; continuous current control; extra wide range; independent excitation; laminated magnetic circuit; high capacity; high efficiency; cool operation; all-purpose meter; and other features necessary to ease of operation, proper performance, and maximum welding economy. The price of the new Diesel engine driven welder compares favorably with that of gasoline engine driven arc welding sets.

THE TALLEST LOCK GATES
IN THE WORLD

Fabricated and Erected
by BETHLEHEM



The lower pair of lock gates at Bonneville Dam on the Columbia River are the tallest ever constructed—100 feet high—as high as a nine-story building. They top by 18 feet the Miraflores Lock gates of the Panama Canal, also built by Bethlehem's construction division.

As the largest steel construction company in the world, with broad experience in every field, Bethlehem is excellently prepared to handle special jobs like this with maximum efficiency.

Bethlehem Steel Company is a unique construction organization in that steel manufacturing, fabricating and erecting are completely coordinated. This integration makes for maximum speed, as the manufacturing divisions supply promptly all the steel materials needed for any job. Fabricating shops and erection equipment at strategic points throughout the country are further factors for speed and efficiency, permitting erection crews to swing into prompt action regardless of the location of the contract.

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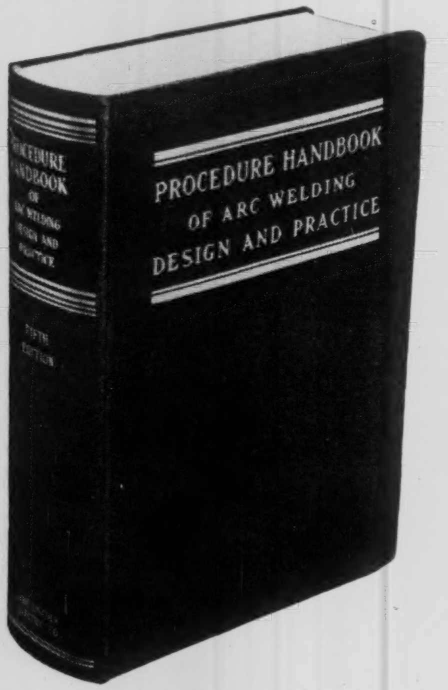
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Arc Welding Handbook

Each year the "Procedure Handbook of Arc Welding Design and Practice" is reissued to include all new data essential for the most efficient use of arc welding. The Fifth Edition, just announced by the Lincoln Electric Co., Cleveland, O., contains 1,012 pages and 1,243 illustrations.



Encyclopedic in scope; written especially for use of designers, engineers, production managers, welding supervisors and operators, the Handbook contains a wealth of data of interest to steel fabricators and erectors, draftsmen, cost estimators, maintenance men and shipbuilders.

The eight sections of the book cover:

- Part I—Welding Methods and Equipment
- Part II—Technique of Welding
- Part III—Procedures, Speeds and Costs for Welding Mild Steel
- Part IV—Structure and Properties of Weld Metal
- Part V—Weldability of Metals
- Part VI—Designing for Arc Welded Steel Construction of Machinery
- Part VII—Designing for Arc Welded Structures
- Part VIII—Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance

Important new structural design data include: new calculations based on up-to-date sizes of mill shapes and on accepted strength value of shielded arc weld metal; additional data on the design of welded girders and welding of thin plates to thick plates; six new studies in the design of trusses of various sizes and applications; profusely illustrated discussion of the new type of beam construction; new information on costs fabricating shop practice.

The Procedure Handbook is $5^3/_4 \times 9$ in., bound in brown semi-flexible simulated leather, gold embossed. Copies will be mailed, post paid, in the United States for $1.50; foreign $2.00 per copy.

Folders Announced

Blade Graders—Mechanical features of "Caterpillar" Blade Graders have been enumerated and discussed in a new booklet entitled "Caterpillar Blade Graders," Form 4254. The advantages of the type of construction which "Caterpillar" employs in its four sizes of graders, have been clearly explained. Caterpillar Tractor Co., Peoria, Ill.

Construction Equipment—The equipment manufactured by A-C for the construction industry; tractors, graders, speed patrols, trailer wagons, crawler tread wagons, and power units, are illustrated and fully described in a 40-page, $5^1/_2 \times 8^1/_2$ in booklet. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Diesel-Electric Generator—A wide range of uses for "Caterpillar" Diesel powered electric generator sets are cited in a new booklet, which also gives the listed ratings of the eight sizes of "Caterpillar" powered generator sets now available. These range in size from a maximum of 80 kw to a minimum of 20 kw. Form No. 4658. Caterpillar Tractor Co., Peoria, Ill.

Engines—A 24-page booklet features the various sizes of the engines and power units, using gasoline, kerosene, or natural gas fuels, manufactured by Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Friction Materials—In a new illustrated brochure, "Industrial Friction Materials," Johns-Manville has gathered together comprehensive data on the complete lines of industrial brake linings and blocks and clutch facings which it manufactures for all types of industrial equipment. The most important feature of this brochure is a chart which simplifies the selection of the most suitable friction material for any specified service. Form FM-7A. Johns-Manville, 22 East 40th St., New York, N.Y.

Graph Sheets—A catalog of graph sheets and coordinate papers, with illustrations of their uses, has been issued by Keuffel & Esser Co., Hoboken, N.J.

Levels—The engineers' 18 in Dumpy Level, Model 19, is illustrated and briefly described in a single sheet which is accompanied by a copy of testimonial letter of highest praise. Buff & Buff Mfg. Co., Jamaica Plain, Boston, Mass.

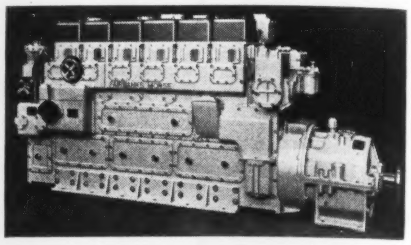
Motor Starters—The newly issued pamphlet, "Five Point Protection Against Explosion and Corrosion with Westinghouse De-Ion Immersed Motor Starters," illustrates the protection features of these starters. A table includes the range of sizes and combinations which are available to meet exact requirements. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penna.

Motors—Construction details of F-M direct-current motors, supplied in sizes up to 200 hp with a variety of mechanical modifications for both high and low voltage operation, are described and illustrated in Bulletin 2260. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Tractors—A 36-page booklet completely illustrates and describes the construction and operation of the spark ignition, oil burning tractors of Allis-Chalmers Mfg. Co., Milwaukee, Wis.

New Convertible Gas and Diesel Engine

Fairbanks, Morse & Co. has announced a series of four-cycle, vertical, convertible Diesel and gas engines. The Model 36-A-8 size is built in both six- and eight-cylinder combinations, with 8 in. bore and $10^1/_2$ in. stroke, and develops 35 hp per cylinder at 720 rpm. Smaller sizes of Model 36-A Diesel are available in ratings as low as 8 hp. Both Diesel and gas engines in the new 8 in. cylinder size are offered for stationary service. The Diesels are offered for marine propulsion and in complete, unit-built Fairbanks-Morse generating sets.

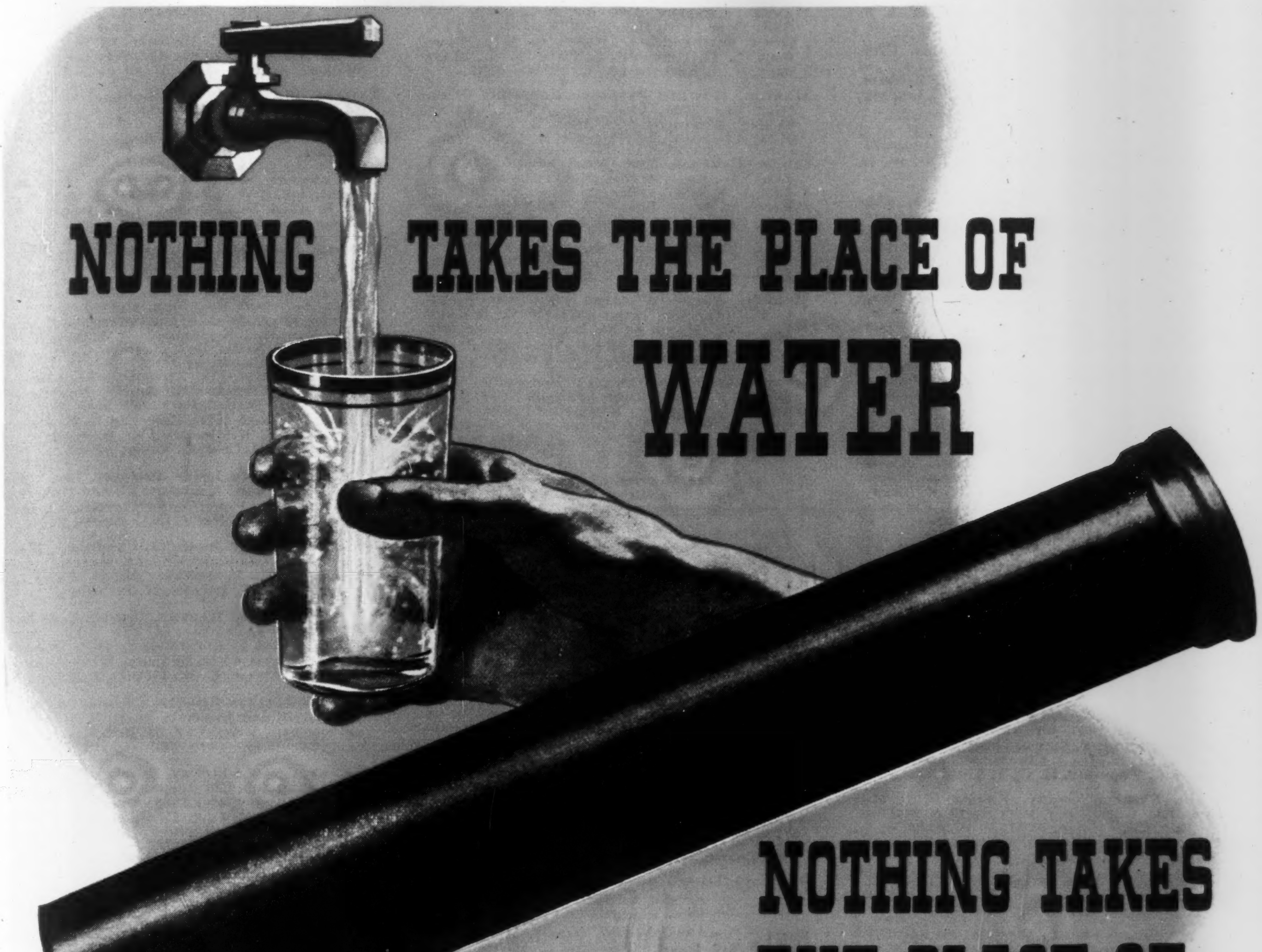


Enbloc construction is employed, with individual cylinder liners, precision main, connecting-rod and cam-shaft bearings, and suspended or "underslung" crankshaft. Side cover-plates permit easy accessibility to main and connecting-rod bearings. The design permits double-end drive or power take-off from either end, a distinct advantage in certain types of application. Additional information can be obtained from Bulletin 3600-A-3, Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

New Truck Mixers

Weight reduction, by the use of high tensile steel and welded construction, yields maximum payloads on the new truck mixers of the Ransome Concrete Machinery Co., Dunellen, N.J. These mixers, attached to the truck chassis with clamps, are available in five sizes from 1 to 4 cu yd capacities.

The swivel discharge chute has 180 deg swing and is furnished in two sections. The second section may be quickly detached and mounted on the operator's platform where it is firmly held in position by lugs and spring clips. The charging door and the discharge door are circular in shape and controlled by hand wheels. The sealing joints are metal to metal joints eliminating the use of gaskets. The water system has been designed to measure the exact amount of water discharged though the truck may not be level.



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Myers, Colby Maxwell, Bonneville, Ore. (Age 35.) Capt., Corps of Engrs., U. S. Army being Res. Engr. on Bonneville Project. Refers to A. Bauer, C. I. Grimm, O. C. Hartman, P. L. Heslop, W. W. Laxton, T. M. Robins, B. E. Torpen.

Nasvik, Peter Oliver, St. Paul, Minn. (Age 25.) Supt., Nasvik Constr. Co. Refers to F. Bass, A. S. Cutler.

Nold, George Jacob, Binghamton, N.Y. (Age 44.) Dist. Engr., U. S. Engr. Office. Refers to C. H. Brown, D. H. Connolly, W. P. Cross, E. L. Daley, M. Elliott, A. W. Harrington, W. L. Kuehnle, C. M. Townsend, M. C. Tyler, L. K. Whitcomb, Jr., J. W. Woermann.

Odell, John Wesley, Buffalo, N.Y. (Age 40.) Div. Engr., Great Lakes Dredge & Dock Co. Refers to J. E. Cahill, L. L. Davis, L. M. Davis, W. P. Feeley, P. H. Niederman, H. C. Woods.

Pohl, Herman Henry, Cincinnati, Ohio. (Age 41.) Major, Corps of Engrs., U. S. Army, being Asst. to Div. Engr., Ohio River Div. Refers to E. L. Daley, G. E. Edgerton, F. J. Fitzpatrick, C. L. Hall, C. E. Hammell, L. P. Murphy, H. M. Waite.

Porak, Henry George, Olympia, Wash. (Age 55.) Engr., Plans & Surveys, State Highway Dept. Refers to E. C. Dohm, R. W. Finke, C. M. Howard, R. C. Knapp, L. V. Murrow, J. L. Stackhouse, R. K. Tiffany.

Ralston, Gerald Edward, Freeport, Ill. (Age 27.) City Engr. Refers to W. R. Spencer, W. H. Wisely.

Ramey, John Kimbrough, Oxford, Miss. (Age 25.) City Engr. Refers to C. E. Downing, A. B. Hargis, R. B. B. Moorman, N. H. Rector.

Redgrave, Gilbert Richard, Swarthmore, Pa. (Age 24.) Asst. to Engr., Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa. Refers to W. S. Lohr, L. Perry, P. P. Rice, E. H. Rockwell, G. F. Roehrig.

Schroder, Frederick Edward, Cranford, N.J. (Age 46.) Engr., Franklin Contr. Co., and Pres., F. E. Schroder, Inc., both of Newark, N.J. Refers to M. Goodkind, J. I. Leonard, C. A. Mead, J. L. Vogel, J. J. Yates.

Searcy, James Kincheon, Vicksburg, Miss. (Age 28.) Jun. Engr. (Hydr.), U. S. Geological Survey. Refers to D. H. Barber, F. C. Snow.

Spalding, Lawrence, Greenville, Pa. (Age 47.) Valuation Engr., Union R.R. Co.; Chairman, Valuation Comm., U. S. Steel Corporation Subsidiary R.Rs. East of Chicago. Refers to R. P. Forsberg, H. E. Hale, F. R. S. Laying, C. S. Leet, W. S. McFetridge, J. H. Roach, E. F. Wendt.

Spalding, Prescott Oulton, Wells, Me. (Age 29.) Constr. Engr., Sanders Eng. Co., Portland, Me. Refers to H. L. Doten, W. S. Evans, E. A. MacLean, E. H. Sprague, B. T. Weston.

Speeg, Kermit Vincent, Vicksburg, Miss. (Age 23.) Jun. Eng. Aide with U. S. Engr. Office. Refers to S. J. Buchanan, G. N. Cox, N. R. Moore, B. W. Pegues.

Spicklemire, Nelson Edwin, Chula Vista, Calif. (Age 44.) Res. Engr., State Div. of Highways, Bridge Dept. Refers to J. R. Head, J. B. Hodges, J. R. McAuliffe, C. M. Mardel, W. H. Overshiner, F. W. Panhorst, A. V. Saph, Jr., D. R. Warren.

Steljes, Martin, New Rochelle, N.Y. (Age 47.) Chf. Engr., Concrete Steel Co., New York City. Refers to J. F. Curley, C. L. Dayton, J. M. Garrelts, D. Gutman, H. Ridgway, E. J. Squire, L. C. Urquhart, R. R. Zipprodt.

Sturgeon, Marvin Gent, Bakersfield, Calif. (Age 24.) Refers to B. A. Etcheverry, C. G. Gillespie, C. G. Hyde, B. H. Mills.

T'ang, Chen-Hsu, Ithaca, N.Y. (Age 27.) Graduate student, Cornell Univ. Refers to F. A. Barnes, S. C. Hollister, E. W. Schoder, P. H. Underwood, L. C. Urquhart, C. L. Walker.

Tatlock, Myron Wilson, Dayton, Ohio. (Age 45.) Supt., Sewage Treatment, City of Dayton Refers to R. A. Allton, E. S. Chase, C. H. Hurd, W. W. Morehouse, H. E. Schlenz, F. D. Stewart.

Tour, Harry Bird, Norris, Tenn. (Age 38.) Archt. for TVA. Refers to A. J. Ackerman, W. B. Allen, H. L. Fruend, B. M. Jones, A. M. Komora, E. Maerker.

Towner, James Madsen, Houston, Texas. (Age 25.) Refers to L. E. Conrad, M. W. Furr.

Tracey, Frank Aloysius, Plainfield, N.J. (Age 34.) Asst. Civ. Engr. and Senior Hydrographic Engr., Board of Commerce and Navigation, Newark. Refers to C. F. Breitzke, C. L. King, C. M. Noble, H. J. Sherman, C. W. Staniford, M. H. Van Buren.

Turnburke, Vernon Palmer, St. Paul, Minn. (Age 49.) Statistician and Gen. Auditor, Great Northern Ry. Refers to O. S. Bowen, R. Budd, H. K. Dougan, W. B. Irwin, D. J. Kerr, A. A. McCree, L. Yager.

Walker, William James, Freeport, Tex. (Age 43.) Res. Engr.-Inspector, FEA of PW. Refers to G. A. Field, T. C. Forrest, Jr., J. G. McKenzie, J. M. Nagle, G. C. Street, Jr.

Welch, Clarence Benning, Cambridge, Mass. (Age 22.) Graduate student, Harvard Univ. Refers to E. L. Durkee, M. O. Fuller, A. Haertlein, H. G. Payrow, H. Sutherland.

Whitley, Fenner Harvey, Brookings, S. Dak. (Age 26.) Instructor in Civ. Eng., South Dakota State Coll. Refers to H. E. Babbitt, H. B. Blodgett, C. E. De Leuw, W. C. Huntington, C. C. Oleson, G. W. Pickels, M. Suter.

Williams, Melvin Ritchie, Atlanta, Ga. (Age 34.) Asst. and Associate Engr., U. S. Geological Survey. Refers to F. M. Bell, N. C. Grover, C. E. McCashin, C. G. Paulsen, J. I. Perrey.

Winzler, George Sidney, Eureka, Calif. (Age 39.) Engr. and Chf. Inspector, City of Eureka, on Mad River Water Project. Refers to R. E. Campbell, J. C. Gist, C. C. Kennedy, W. A. Perkins, E. N. Prouty.

Zalmanzig, Fred Dodge, San Antonio, Tex. (Age 25.) Research Engr., San Antonio Public Health Service. Refers to J. T. L. McNew, T. A. Munson, C. E. Sandstedt, W. E. Simpson, E. W. Steel.

FOR TRANSFER

From the Grade of Associate Member

Biedinger, John Robert, Assoc. M., Cincinnati, Ohio. (Elected June 11, 1917.) (Age 50.) Cons. Structural Engr. Refers to W. W. Carlton, H. W. Hanly, F. F. McMinn, F. L. Raschig, J. E. Root, C. Wuest, Jr.

Bringhurst, John Henry, Assoc. M., Houston, Tex. (Elected Jan. 3, 1911; Assoc. M., March 2, 1915.) (Age 52.) Chf. Engr., American Petroleum Co. of Texas. Refers to E. C. H. Bantel, W. A. Blakemore, R. J. Cummins, L. M. Gram, E. N. Noyes, H. E. Riggs, C. J. Tilden.

Gillette, Paul Clifford, Assoc. M., Binghamton, N.Y. (Elected Aug. 4, 1924.) (Age 45.) Engr. in charge of design of dams and reservoirs, U. S. Engr. Corps, War Dept. Refers to A. S. Crane, W. P. Creager, L. F. Harza, J. Kappeyne D. W. Mead, A. Schultheis.

Hall, Walter William, Assoc. M., McAllen, Tex. (Elected July 12, 1926.) (Age 44.) Associate Engr., International Boundary Comm., United States and Mexico. Div. Engr., Lower Rio Grande Flood Control Project in Hidalgo County, Tex. Refers to S. F. Crecelius, R. J. Cummins, L. M. Lawson, J. L. Lytel, E. N. Noyes, F. H. Shaw.

From the Grade of Junior

Bagley, Harry Howe, Jun., Hasbrouck Heights, N.J. (Elected March 14, 1927.) (Age 32.) Designer and Checker with Turner Constr. Co. Refers to E. K. Abberley, W. Allan, H. L. Muchemore, J. P. H. Perry, R. Ridgway.

Chettle, Earl Vincent, Jun., Denver, Colo. (Elected July 23, 1934.) (Age 32.) Asst. Engr., U. S. Bureau of Reclamation. Refers to T. C. Adams, M. S. Bitner, N. Enger, R. B. Ketchum, F. H. Richardson.

Crocker, Forrest Samuel, Jun., Denver, Colo. (Elected May 28, 1934.) (Age 32.) Engr. with Utah Bechtel Morrison Kaiser Co. Refers to C. L. Eckel, R. Follansbee, R. C. Gowdy.

L. R. Howson, G. Perrine, A. O. Ridgway, R. Ridgway, R. J. Tipton.

Cullum, Robert Severne, Jun., Coleman, Tex. (Elected March 15, 1937.) (Age 32.) Dist. Field Supervisor and Supervisor of Safety, Dist. 19, San Angelo, Tex., Area Engr., Area 40, Coleman, Tex,. WPA. Refers to E. A. Baugh, J. C. Bisset, H. T. Boyle, H. W. English, H. P. Kay, T. C. Shuler.

Davis, Harmer Elmer, Jun., Berkeley, Calif. (Elected Oct. 1, 1928.) (Age 32.) Asst. Prof. of Civ. Eng., and Associate Research Engr. in Eng. Materials Laboratory, Univ. of California. Refers to R. E. Davis, C. Derleth, Jr., H. D. Dewell, F. S. Foote, B. Jameyson, J. W. Kelly, G. E. Troxell, C. T. Wiskocil.

De Hart, Stanley Burson, Jun., Augusta, Ga. (Elected Oct. 30, 1933.) (Age 32.) Inspector, U. S. Engr. Dept. Refers to L. D. Brownell, H. P. Hammond, W. K. Hatt, W. A. Knapp, L. F. Rader, R. Ridgway, E. J. Squire.

Derry, Stephen John-Arthur, Jun., Akron, Ohio. (Elected Nov. 27, 1933.) (Age 32.) Instructor, Firestone Service School, Firestone Tire & Rubber Co. Refers to J. P. Ambler, M. L. Davis, H. K. Kistler, H. S. Mattimore, D. W. Mead, F. L. Plummer, W, L. Stanton, H. R. Thayer, E. D. Walker.

Dunbar, T. J., Jr., Jun., Pearland, Tex. (Elected Oct. 31, 1933.) (Age 28.) County Engr., Brazoria County. Refers to R. P. Boyd, G. R. Brown, J. A. Focht, C. L. Hasie, M. P. von Homeyer, L. A. Peterman, C. P. Smith, J. P. Stockton, Jr.

Eaton, Edwin Harvey, Jun., Tuckahoe, N.Y. (Elected Nov. 12, 1928.) (Age 32.) Engr., Mortgage Corporation of New York. Refers to E. G. Adams, A. H. Jorgenson, J. Mechanic, A. N. Van Vleck, S. Wilmot.

Henderson, Ernest Ray, Jun., Mineola, Tex. (Elected Oct. 26, 1931.) (Age 32.) Surveyman, U. S. Engr. Dept., Galveston, Tex. Refers to T. E. Huffman, C. H. Kendall, J. T. L. McNew, J. J. Richey, W. R. Spencer, E. C. Woodward.

Kiely, John Roche, Jun., Fernandina, Fla. (Elected Oct. 26, 1931.) (Age 31.) Res. Engr., Fernandina Pulp & Paper Co. Refers to R. M. Angas, C. W. Harris, R. P. Hutchinson, C. C. More, R. G. Tyler, G. A. Youngberg.

Levy, George, Jun., Brooklyn, N.Y. (Elected Oct. 24, 1932.) (Age 32.) Asst. Engr. of Constr., Dept. of Parks, City of New York. Refers to A. M. Anderson, H. R. Codwise, H. P. Hammond, L. F. Rader, E. J. Squire.

McGaw, Alex James, Jun., Laramie, Wyo. (Elected Feb. 11, 1935.) (Age 29.) Instructor, in Civ. Eng., Univ. of Wyoming; member of firm, Flora & McGaw, Engrs. Refers to E. W. Burritt, J. B. Cleary, W. H. Fisher, R. D. Goodrich, E. K. Nelson, H. T. Person, N. Williams.

Miller, Roger Light, Jun., Cheltenham, Pa. (Elected March 5, 1928.) (Age 32.) Asst. Project Engr., Sun Oil Co. Refers to H. F. Bachman, W. A. Courtenay, Jr., J. V. Esposito, W. Samans, P. M. Sax.

Reuter, Bernard Vincent, Jun., Brooklyn, N.Y. (Elected Oct. 24, 1932.) (Age 28.) Secy., Louis W. Reuter, Jr., Inc., City Surveyor. Refers to H. R. Codwise, P. P. Farley, H. P. Hammond, L. F. Rader, E. J. Squire.

Stephenson, Leonidas Dacosta, Jr., Jun., Old Town, Maine. (Elected June 4, 1928.) (Age 31.) Instructor in Civ. Eng., Univ. of Maine, Orono, Maine. Refers to H. S. Boardman, W. S. Evans, H. W. Hemple, E. W. Madlung, C. L. Mann, E. H. Sprague, H. Tucker.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 117 of the 1938 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

CONSTRUCTION

Construction Engineer; Assoc. M. Am. Soc. C.E.; associate member, Western Society of Engineers; 33; married; 3 years general construction; 8 years on hydroelectric developments; 3 years on soil-erosion control. Desires position with reputable contracting or engineering firm. Now employed but available on short notice. Location immaterial. C-315.

Civil or Construction Engineer; Jun. Am. Soc. C.E.; B.S.C.E., 1932, from Carnegie Institute of Technology; 7 years of progressive field and office experience, including 1 year and 4 months on highways and 5 years and 8 months on lock and dam construction; capable of taking charge, field or office; employed; desires permanent connection. Available on short notice. C-320.

EXECUTIVE

Civil Engineer; Jun. Am. Soc. C.E.; 31; B.S. in C.E., 1929; married; 4 years in charge of planning and construction of municipal works, in cooperation with federal works programs; 5 years of earth dam construction; general surveying experience; special interest, long-range planning. C-318.

Civil Engineer; Assoc. M. Am. Soc. C.E.; technical graduate; registered; married; Protestant; 22 years experience with contractors. Estimating and contracting highway bridges, water and sewer lines, filtration and sewage-disposal plants. Good knowledge of office procedure. Now employed. Prefers connection with contractor. C-322.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 34; married; B.S.C.E.; 7 years railroad maintenance and structures; 3 years as designing draftsman on sewers, water works, and smelter structures; 2 years appraisal work on hydroelectric plants. Desires permanent connection, preferably in West. Available on reasonable notice. C-324.

Engineer; M. Am. Soc. C.E.; manager of building contracting business seeking change of association to select Eastern firm with broader field; 25 years experience in charge of business contacts, estimating, bidding, closing contracts, purchasing, supervision, jobs up to half-million size. Record for acquiring desirable contracts producing profit and good-will by intensive management. C-326.

Civil Engineer; M. Am. Soc. C.E.; more than 20 years railroad experience, including extensive construction and maintenance work as location; preparation of plans and estimates; reports on line improvements; relocation of lines for flood prevention; consolidation of lines with other railroads; design of large hump, retarder yards, and maintenance work, chief engineer's office of railroad system. C-327.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 35; married; graduate of Rensselaer Polytechnic Institute; licensed professional engineer, New York State; $10\frac{1}{2}$ years engineering experience (5 in charge of construction, $2\frac{1}{4}$ design, $2\frac{1}{4}$ charge survey, 1 sub-professional); park and parkway development and similar work. Also 3 years editorial experience and some instruction. Can direct and organize. C-331.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 33; married; graduate of Massachusetts Institute of Technology; licensed New York. Executive and administrative experience and ability. Experienced construction work for production, transportation, storage, and refining of oil; railway, sewer, water-supply, harbor, and building construction; plane table surveys—South America, Asia, United States. Fluent French, Spanish, Persian. Immediately available, any location. C-336.

JUNIOR

Engineer; Jun. Am. Soc. C.E.; 29; single; B.S. in C.E., New York University. Experienced in public relations (Latin-America), personnel, purchasing, and direction and supervision of highways, public buildings, hydraulic research work. Possesses tact and personality; inspires confidence. Knowledge of Spanish, Italian, and French. Location immaterial; prefers foreign service. C-316.

Graduate Civil Engineer; Student Chapter member; single; young; 2 years experience in building construction and alteration; 6 months in railway track-laying and maintenance. Other experience covers general drafting and design of water and sewage plants. Qualified as safety engineer. Desires position with construction or design firm. Location immaterial. Excellent references. Available now. C-314.

Civil Engineer; Jun. Am. Soc. C.E.; B.S. in C.E.; age 29; married; $2\frac{1}{2}$ years in charge of estimating, cost accounting, and purchasing for a large construction organization; 2 years structural and topographical drafting; $1\frac{1}{2}$ years field and office work for general contractor. Location immaterial. Available immediately. C-319.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 27; single; 3 years experience in charge of five-man precise level party; 18 months experience engineering department of railroad; 9 months experience supervision and inspection of construction with large corporation. Location immaterial; available immediately. C-321.

Civil Engineer; Jun. Am. Soc. C.E.; 22; single; S.B. in C.E., Massachusetts Institute of Technology, 1937; 4 months experience with U. S. Engineers on flood-control work; 2 months in soils mechanics laboratory, and 2 months with topographical party. Location immaterial. Available immediately. C-323.

Civil Engineer; Jun. Am. Soc. C.E.; University of Pittsburgh, 1936; Sigma Tau; 31; married; desires work, either field or office; 14 months general experience in engineering office, buildings, grounds, and power division of large company. Location immaterial; available at once. C-328.

Engineer; Jun. Am. Soc. C.E.; 30; married; 3 years civil engineering schooling; 8 years varied experience; reliable party chief, computer, and transitman; previously engaged on highway, railway, subway, transmission line, reservoir, triangulation, mapping, and construction. Location immaterial; now employed in South; available on short notice. Inquiries answered promptly. C-329.

Civil Engineer; Jun. Am. Soc. C.E.; single; B.S.C.E., University of Illinois, 1936; $1\frac{3}{4}$ years testing and inspection of highway construction materials, and work in soils mechanics. Desires position with future in structural design and construction, or sales engineering. West Coast preferred. Available on two weeks notice. C-333-383-A-7, San Francisco.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Kansas State College, 1933; 1 year experience in construction of natural gas pipe line and booster station; $2\frac{1}{2}$ years topographic surveying and drafting; 8 months pile-dike and levee construction. Location immaterial; available immediately. C-334.

TEACHING

Hydraulic Engineer; Assoc. M. Am. Soc. C.E.; Ph.D. (Iowa); 37; married; 12 years teaching experience; administrative and research experience; German, French, and Italian; now engaged in hydraulic research. Desires teaching and research position in hydraulics and allied subjects; location immaterial. C-317.

Professor of Civil Engineering, Mechanics, and Materials; Assoc. M. Am. Soc. C.E.; registered civil, mechanical, structural engineer, and surveyor; M.S.C.E.; 8 years engineering practice; administrative and executive experience; 15 years teaching mechanics, materials, surveying, highways, and structures.

Now department head Available as professor of civil engineering, mechanics and materials, or head of engineering department. C-325.

Civil Engineer; Assoc. M. Am. Soc. C.E.; married; 36; B.Sc., University of California; M.Sc.; Chi Epsilon; California Junior College teaching certificate; 6 years on staff of major university teaching mechanics, hydraulics, highways, surveying, engineering economics; 8 years analysis, design, construction of hydraulic works, highways. Now employed. Desires position as assistant professor or better with opportunity for advancement. C-330.

Civil Engineer; M. Am. Soc. C.E.; married; licensed; 13 years experience teaching all branches of geodesy and surveying in large engineering college; 13 years additional experience in geodetic, hydrographic, and topographic surveys and flood control, geodetic computations, and state coordinate systems. Will go anywhere. Available at once. C-332.

Associate Professor; Assoc. M. Soc. C.E.; single; 32; B.S.C.E.; 15 years civil engineering experience covering supervision of highway construction, design, and material research (soil mechanics); 4 years experience in engineering teaching; desires permanent position teaching civil engineering or allied subjects with opportunity for graduate or research work; now employed as instructor. Available September. C-335.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 108 of the Year Book for 1938. The notes regarding the books are taken from the books themselves. and this Society is not responsible for them.

Akustik und Schallschutz im Hochbau (Sammlung Göschen 1119). By E. Michel. Berlin and Leipzig, Walter de Gruyter & Co., 1938. 157 pp., illus., diagrs., charts, tables, 6 × 4 in., cloth, 1.62 rm.

This small treatise on acoustics and the soundproofing of buildings is divided into two main sections. One has to do with the internal acoustics of rooms of varying shapes, and the other with the effects and methods of exclusion of exterior noise, taking into account structural details.

Bauforschungen, Vol. 4. **Die Austrocknung von Mauerwerk.** By R. Dittrich. Berlin and Leipzig, Verlagsgesellschaft Rudolf Müller, 1937. Illus., diagrs., charts, tables, 12 × 8 in., paper, 5.20 rm.

In this discussion of extensive researches on the drying of masonry there is a statement as to the properties of the various building stones used, a description of the test methods, the varying combinations of stone and mortar examined, and a comparison of the results obtained under natural and artificial conditions.

Beihefte zum Gesundheits-Ingenieur, Reihe II, Heft 18. Der künstlich belüftete Tropfkörper. By R. Pönninger. Munich and Berlin, R. Oldenbourg, 1938. 25 pp., illus., diagrs., charts, tables, 12 × 9 in., paper, 5.60 rm.

In this discussion of the effect of artificial aeration on sewage in trickling filters the test equipment and methods are described and the results are given with respect to temperature relations, bacterial action, method of aeration, and efficiency of the process.

Diesel, der Mensch, das Werk, das Schicksal. By E. Diesel Hamburg, Hanseatische Verlagsanstalt, 1937. 491 pp., illus., 9 × 5 in., cloth, 7.50 rm.

This first comprehensive biography of Diesel has been written by his son. His ancestry and early life, work and inventions, periods of despair and of success are described, together with an account of his travels, including the last trip by boat, from which he so strangely disappeared.

Essentials of Engineering Mathematics. By J. P. Ballantine. New York, Prentice-Hall, 1938. 502 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.75.

A unified treatment of mathematics has been used in this practical introduction to the calculus. Differential and integral calculus are considered side by side with those parts of analytic geometry, trigonometry, and college algebra that seem logically connected with or dependent on the calculus. Problems and logarithmic and trigonometric tables are included. Certain new features, such as the rigorous treatment of integrals as antidifferentials, are incorporated in the presentation.

Great Britain. Dept. of Scientific and Industrial Research and Ministry of Transport. "Road Research" Technical Paper No. 2. **Studies in Road Friction. II. An Analysis of the Factors Affecting Measurement.** By G. Bird and R. A. Miller. London, His Majesty's Stationery Office, 1937. 36 pp., illus., diagrs., charts, tables, 10 × 6 in., paper (obtainable from British Library of Information, 270 Madison Ave., New York, 35 cents).

A description of some of the experimental work done, and the conclusions drawn from the data gathered, in a study of the factors affecting the measurement of friction between a pneumatic-tired wheel and a road surface is given here. The limiting values considered are for right-angle side slip and forward slip, in each case while the wheel is rotating.

Grosse Ingenieure, Lebensbeschreibungen aus der Geschichte der Technik. By C. Matschoss. Munich and Berlin, J. F. Lehmanns Verlag, 1937. 334 pp., illus., 9 × 6 in., cloth, 8.40 rm. (6.30 rm. in the United States).

These short biographies of a number of great engineers from all periods of history give information concerning their lives rather than their technical work. The first section includes men of antiquity; the second covers the Middle Ages and Renaissance to the industrial revolution, dealing especially with Germans; the last, beginning with James Watt, ends with Oskar von Miller (Deutsches Museum).

Heating, Ventilating, Air Conditioning Guide, 1938. Vol. 16. New York, American Society of Heating and Ventilating Engineers, 1938. 1188 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $5.

This valuable reference book is compiled by a committee of the American Society of Heating and Ventilating Engineers, in order to provide the technical data needed by designers and constructors of heating, ventilating, and air-conditioning systems in convenient, usable form. The new edition has been carefully revised, especially in the chapters dealing with air conditioning, and a new chapter on air conditioning in the treatment of disease has been added.

How to File Papers and Records. By A. Chaffee. New York and London, McGraw-Hill Book Co., 1938. 186 pp., illus., diagrs., charts, tables, 8 × 6 in., cloth, $2.

Filing systems and their operation, filing routines, and filing equipment are discussed in detail, showing the advantages inherent in certain types, which make them particularly valuable in various specific cases. This volume is useful both for the office manager who wants the system best suited to his purposes, and for the clerk who wishes to become proficient in filing.

How to Keep Accounts and Prepare Statements. By E. A. Saliers. New York, Ronald Press Co., 1938. 481 pp., charts, tables, 8 × 5 in., cloth, $3.

This text is intended for those who wish a practical understanding of accounting, but lack time or opportunity for a formal course of instruction. It presents a course in principles, with full explanations, which will give a working familiarity with methods and equip the reader to prepare the statements usually required in business.

Landslides and Related Phenomena: a Study of Mass-Movements of Soil and Rock. By C. F. Stewart Sharpe. New York, Columbia University Press, 1938. 153 pp., illus., tables, diagrs., $9^1/_2 \times 6\ ^1/_2$ in., cloth, $3.

In this study, the results of previous work in all fields of mass-movement are brought together and summarized. New material is furnished from original field studies covering all the most important areas of landslide and flow phenomena in the United States and southern Canada. A new classification of landslides and related phenomena, showing these types of mass-movement as part of a continuous series, grading from dry debris movement into fluvial and glacial transportation, is presented.

New Horizons in Planning. Proceedings of the National Planning Conference, June 1–3, 1937. Chicago, American Society of Planning Officials, 1937. 178 pp., 9 × 6 in., cloth, $2.

Proceedings of the National Planning Conference for 1937, in which four national planning organizations participated, containing a collection of papers on various phases of city, metropolitan, county, state, regional, and national planning.

Principles and Practice of Surveying. Vol. 1, Elementary Surveying. By C. B. Breed and G. L. Hosmer. 7 ed. New York, John Wiley & Sons, 1938. 717 pp., illus., diagrs., charts, tables, 8 × 5 in., leather, $4.

This standard textbook contains the essentials of a comprehensive knowledge of practical surveying. Part I covers the use, adjustment, and care of instruments designed to measure distances, directions, angles, and elevations. Part II describes surveying methods, including astronomical observations and mine surveying. Parts III and IV cover, respectively, computations and plotting. Necessary tables are included, and the planimeter is discussed in an appendix.

Principles and Practice of Surveying (Vol. 2): **Higher Surveying**, 5 ed. By C. B. Breed and G. L. Hosmer. New York, John Wiley & Sons, 1938. 674 pp., illus., diagrs., charts, maps, tables, 7 × 5 in., leather, $3.50.

This revised edition of a standard work covers the various types of surveying beyond the scope of the fundamental treatments discussed in Vol. I. Triangulation, astronomical observations, and precise, trigonometric, and barometric leveling are considered in one group. Stadia and plane-table work and the relation of geology to topography form the next part. Part III covers terrestrial and aerial photographic surveying, and Part IV, hydrographic work. Following the final section on map construction and finishing come several pages of tables. The text has been extensively revised.

Sewers. By E. V. Bevan and B. T. Rees. London, Chapman & Hall, 1937. 334 pp. illus., diagrs., charts, tables, 9 × 6 in., cloth 25s.

This volume is intended as a practical reference book for the designer and builder. The fundamental principles of sewer design are presented, and methods of construction and the properties of materials are discussed in some detail. Chapters are devoted to the execution of construction, to office organization, and to measuring and billing the work.

Statically Indeterminate Structures. By F. L. Plummer. Ann Arbor, Mich., Edwards Brothers, 1937. 104 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, $1.50.

The important subject of statically indeterminate structures is again treated in this recent publication. Following an introductory chapter comes one on the determination of deflections. General analysis of redundant structures precedes a large chapter explaining the following special methods of analysis of indeterminate structures: three-moment; fixed and conjugate point; slope deflection; moment distribution; restraining stiffnesses; column analogy; and model analysis. An illustrative example of analysis of concrete building frames closes the book.

Storstrøms Broen. Edited by De Danske Statsbaner. Copenhagen, Denmark, 1937. 91 pp., illus., diagrs., charts, maps, tables, 12 × 8 in., paper, apply.

An illustrated account of the construction of a combined railway, highway, and pedestrian traffic bridge over the Storstrøm in Denmark. Historical material concerning this crossing is given, and there is a description of the work done on the foundations, superstructure, roadways, and adjacent structures.

Trautwine, the Civil Engineer's Reference-Book, 21 ed. By J. C. Trautwine and J. C. Trautwine, Jr. Ithaca (N.Y.), Trautwine Co., 1937. 1514 pp., diagrs., charts, tables, 7 × 4 in., leather, $7.

"Trautwine" was first published in 1872 and for many years enjoyed supremacy as the reference book of the American civil engineer. The last previous edition appeared twenty years ago. Much of the present issue is from the same plates, but some additions have been made, notably a long section upon hoisting, excavating, and conveying machinery.

Van Nostrand's Scientific Encyclopedia. New York, D. Van Nostrand Co., 1938. 1233 pp., illus., diagrs., charts, tables, 11 × 8 in., leather, $10.

This encyclopedia aims to provide a reference book covering the basic sciences of physics, chemistry, mineralogy, geology, botany, astronomy, and mathematics, and the applied sciences of engineering, medicine, navigation, and aeronautics. Over ten thousand terms of interest are included, with definitions and fundamental information. The articles are clear and concise, illustrations are used freely, and the information appears to be accurate and up to date. The arrangement is alphabetical, with numerous cross-references, and the work can be recommended as filling a decided want.

Zurich. Eidg. Technische Hochschule. Mitteilungen aus dem Institut für Baustatik, No. 9. **Eingebettete Rohre** statische Untersuchung Überschütteter Leitungen mit Berücksichtigung ihrer Elastizität. By A. Voellmy. Zurich and Leipzig, Gebr. Leemann & Co., 1937. 151 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 6 rm.

Mathematical analysis of earth pressure and loads on embedded structures, particularly on hollow circular structures, is given here. In Chapter I deformation conditions are neglected, while in Chapter II the deformation is considered in determining stresses. Actual tests are described, and the last chapter contains practical calculations for the particular case of buried pipe lines. There is a bibliography.

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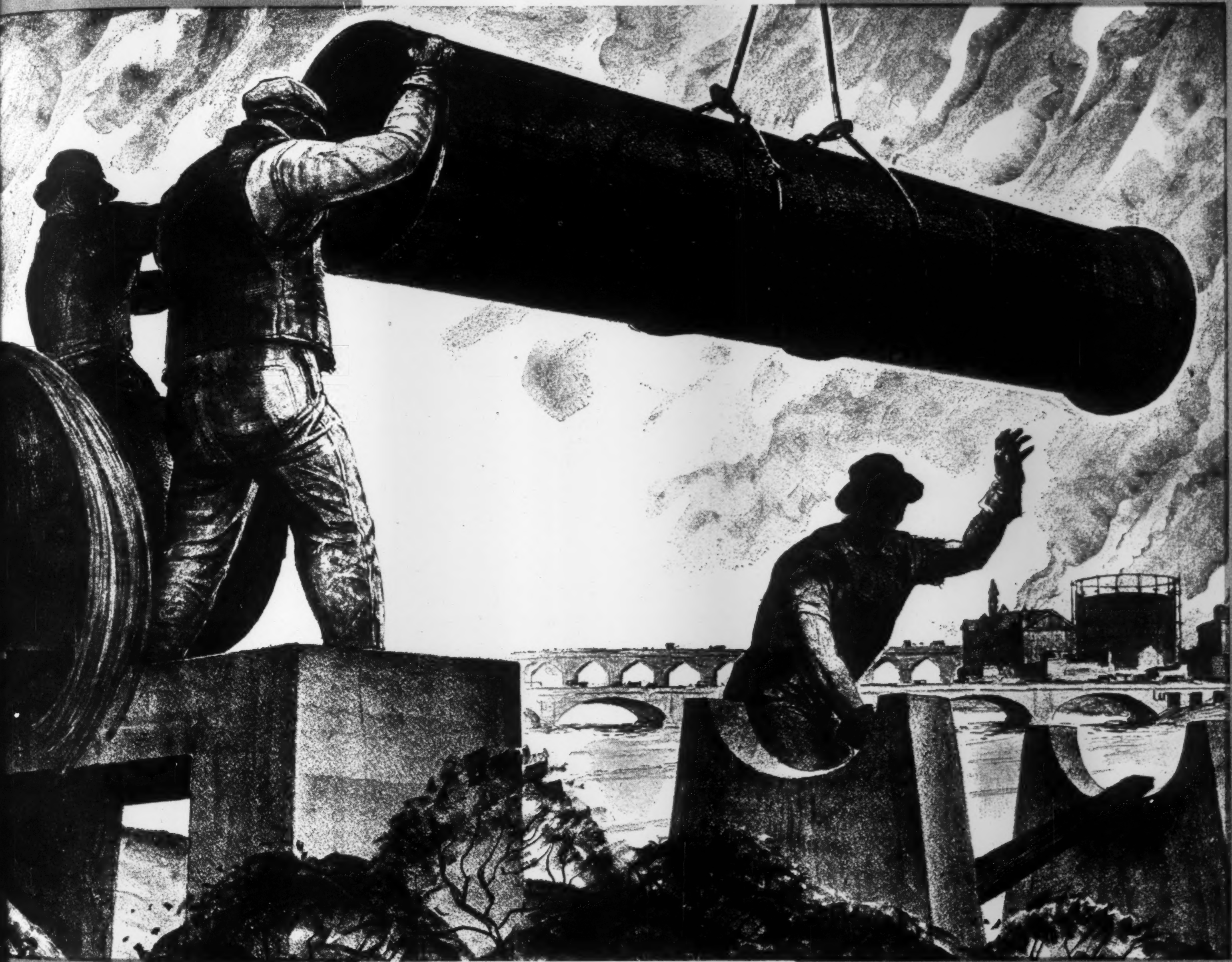

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BRIDGES

Concretb Arch, Great Britain. Reconstruction of Carmarthen Bridge. *Concrete & Constr. Eng.*, vol. 33, no. 2, Feb. 1938, pp. 83–99. Design and construction of new bridge over river Towy, consisting of three hingeless reinforced concrete arches with spans of 70, 60, and 52 ft, and width of 42 ft between parapets; construction of cofferdams and piers.

Concrete Arch, India. Gul Kach Bridge, A. S. Barton. *Roy. Engrs. J.*, vol. 52, Mar. 1938, pp. 2–14, supp. plates. Design and construction of reinforced concrete highway bridge of 174-ft span, over Gomal River at Gul Kach, near Baluchistan border, India.

Concrete, Washington. Concrete Box-Girders of Record Span, F. R. Easterday. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, pp. 339–342. Design and construction of recently completed two-lane highway bridge across Henderson Bay at Purdy, Wash., featuring central span of 190 ft, believed to be longest of hollow, box-girder concrete type thus far built; test results; cost data.

Concrete, Wrecking. Demolition of Reinforced-Concrete Bridges, J. Spottiswoode. *Roy. Engrs. J.*, vol. 52, Mar. 1938, pp. 73–90, supp. plates. Review of methods of demolition of concrete girder and concrete arch bridges, in connection with military operations.

Floors. Roadways on Bridges, E. W. Bowden. *Eng. News-Rec.*, vol. 120, no. 11, Mar. 17, 1938, pp. 395–399. Review of design trends in roadways of bridges recently built at New York City; traffic lanes; roadway structural design; details for anchoring slabs to steel supports; roadways on Bayonne Bridge and George Washington Bridge; grating type expansion joint used at towers of Triborough and George Washington suspension bridges.

Floors, Concrete Pavement. Light Weight Concrete Pavement on San Francisco-Oakland Bay Bridge, G. B. Woodruff. *Am. Concrete Inst.—J.*, vol. 9, no. 3, Jan.-Feb. 1938, pp. 225–238. Design and construction of light-weight concrete pavement of San Francisco–Oakland Bay suspension bridge; structural design of slab; aggregate specifications; paving operations; vibrating base course.

Lift, New York. Erecting Marine Parkway Bridge, W. K. Greene and E. E. McKeen. *Eng. News-Rec.*, vol. 120, no. 10, Mar. 10, 1938, pp. 371–374. Construction of new steel-truss highway bridge over Rockaway inlet in New York City, 3,839 ft long, containing 540-ft through-truss lift-span flanked on each end by 540-ft through-truss fixed span and six deck-truss spans varying in length from 97 to 214 ft; 14 spans assembled on barges and floated into place; details of open-mesh floor.

Steel Arch, Niagara Falls. Niagara Arch Memories, R. S. Buck. *Eng. News-Rec.*, vol. 120, no. 8, Feb. 24, 1938, pp. 297–298. History of Falls View, 840-ft, steel-arch bridge, in Niagara River gorge, recently destroyed by unusual ice jam; ice damage on two previous occasions.

Steel Truss, Wrecking. Unique Bridge Rolling Procedure Proves Highly Effective. *Ry. Age*, vol. 104, no. 3, Jan. 15, 1938, pp. 152–156. 222-ft, heavy-truss span, on Pennsylvania Railroad is raised and rotated about pivoted corner, across four high-speed tracks, to permit dismantling in clear.

Suspension, Great Britain. Reconstruction of Menai Bridge. *Engineering*, vol. 144, no. 3752, Dec. 10, 1937, pp. 651–652. Brief note on scheme to reconstruct Telford's historic suspension bridge over Menai Strait; essential features of Telford's design, including approach viaducts and towers, to be retained; details of present bridge started in 1818; alterations involve replacement of four spans of wrought-iron chain by two side spans of high tensile steel and provision of new deck capable of carrying traffic without restriction.

Viaducts, Concrete. Concrete Viaduct Tested to Destruction, M. Butler. *Eng. News-Rec.*, vol. 120, no. 7, Feb. 17, 1938, pp. 273–275. Analysis of destruction of portion of Riverside Drive concrete trestle viaduct, Los Angeles, Calif. under enormous overload, side thrust, and impact caused by Elysian Park slide.

BUILDINGS

Acoustics. Predetermination of Speech Levels in Auditoria with Coupled Spaces, G. E. Morison. *Acoustical Soc. America—J.*, vol. 9, no. 3, Jan. 1938, pp. 244–254. Theoretical considerations; attenuation with boundary adsorption; impedance change loss; practical applications; experimental results.

Air Conditioning. Effect of Air Conditioning on Building Design, A. W. Canney. *Arch. Rec.*, vol. 83, no. 2, Feb. 1938, pp. 72–81. Relations between architectural planning and air conditioning; room configuration or size limitations which influence air-conditioning results; relation of air conditioning to spatial conditions.

Air Conditioning, Hospitals. Result of Air Conditioning Hospital, A. G. Young. *Heating & Vent.*, vol. 35, no. 2, Feb. 1938, pp. 55–56. Observations on effects of air conditioning on patients in first year's operation of plant at Corey Hill Hospital, Boston. Before Air Conditioning Bur. of Boston.

Concrete. Reinforced Concrete Frame Buildings. *Concrete & Constr. Eng.*, vol. 33, no. 1, Jan. 1938, (supp.) pp. 1–34. Development of concrete-frame and steel-frame buildings in England in recent years; advantages of this type of construction; descriptive notes and 23 pages of photographs.

Exhibition Buildings, Australia. Build for Use with Welding, R. J. Bridgeland. *Industry & Welding*, vol. 10, no. 10, Oct. 1938, pp. 47 and 50–53. Illustrated description of methods employed in construction of Centennial Hall, South Australia, which is to be used for exhibition purposes; way in which welding was used.

Framed Structures, Wind Stresses. Speedy and Accurate Method of Wind Stress Calculation for High Storied Bents, F. Takabeya. *Hokkaido Imperial Univ.—Faculty Eng.—Memoirs*, vol. 4, no. 2, Dec. 1937, pp. 75–114. Theoretical mathematical discussion outlining use of slope-distribution method to calculation of wind stresses in multiple-story structures; numerical examples. (In English.)

Indo-China. Halles en Béton Armé, Servant de Marches, dans le sud de l'Indochine, W. Kandaouroff. *Génie Civil*, vol. 112, no. 2890, Jan. 1, 1938, pp. 11–13. Description of recently completed reinforced concrete market buildings in principal cities of southern Indo-China.

Plastics. Noted at Paris Exposition, B. Kogan. *Modern Plastics*, vol. 15, no. 5, Jan. 1938, pp. 34–35, 64, and 66. Comment on use of cellulose acetate plastics at Paris International Exposition in fields of architecture, decoration, furniture, fashion, lighting, and publicity.

Soundproofing. Objective Experiments in Sound Resistance of Actual Building Elements, A. H. Douglas and F. R. Himsworth. *Structural Engr.*, vol. 16, no. 3, Mar. 1938, pp. 98–104 and 110. Description of equipment and methods used in testing sound transmission through walls, doors, windows, and other elements of houses. Before Instn. Structural Engrs.

Steel, Welded. Speed and Quiet Feature Welded Building Erection. *Industry & Welding*, vol. 10, no. 9, Sept. 1937, pp. 63–64. Description of two-story building which employed new welded rigid-frame saw-tooth design utilizing "tree-form" columns.

CITY AND REGIONAL PLANNING

Germany. Die staedtebauliche Neugestaltung der Reichshauptstadt. *Verkehrstechnik*, vol. 19, no. 3, Feb. 5, 1938, pp. 52–54. Modern city planning in Reich's capital; description of recent improvements on basis of layout maps.

Great Britain. Practical Application of Restriction of Ribbon Development Act, 1935, in Relation to Town Planning and Highway Improvement, J. G. Jefferson. *Instn. Mun. & County Engrs.—J.*, vol. 64, no. 3, Aug. 3, 1937, pp. 273–289, (discussion) 290–303. Study of act in relation to town planning; road design and practical application of section I; conditions as to buildings; application of act to built-up areas.

Great Britain. Town Planning of Leicester and Re-Development of Central Area, G. A. Kinman. *Instn. Mun. & County Engrs.—J.*, vol. 64, no. 3, Aug. 3, 1937, pp. 247–272, (discussion) 290–303. Historical developments of city plan of Leicester since beginning of seventeenth century to present time; estate development; character zoning in built-up areas; control of design and external appearance of buildings.

Great Britain. Town Planning in London, G. L. Head. *Chartered Surveyors' Instn.—J.*, vol. 17, pt. 9, Mar. 1938, pp. 139–172. Critical discussion including forecast of general tendency of London town planning schemes, which are now in process of being drafted, and of their effects upon economy of building world.

Maryland. *Regional Planning. Pt. IV—Baltimore-Washington-Annapolis Area.* Baltimore (Md.), Maryland State Planning Commission, Nov. 1937, 65 pp., figs., illus., diagrs., tables, maps, 40 cents. Report of consultants to subcommittee; historical background; land uses; public services; rôle of public action; population data; soil and manufacturing data; zoning; legislation. Bibliography.

Streets. Relation of Traffic Density to Town Planning Zoning, H. F. Payne. *Instn. Mun. & County Engrs.—J.*, vol. 64, no. 4, Aug. 17, 1937, pp. 385–395, (discussion) 396–408. Compilation of figures for forecasting traffic derivable from any future building development, so that highways may be designed with sufficient width to take such traffic; information has been prepared from traffic censuses taken since 1932 in city of Portsmouth, England.

United States. Population Statistics 3. Urban Data. *U. S. Nat. Resources Committee—Population Statistics*, Oct. 1937, 52 pp, 15 cents. Urban population changes; growth of cities in United States; variations of urban growth; density of population in cities; sources of urban growth; changes in occupational composition; metropolitan regions as centers of population and as economic centers; metropolitan regions and their area of influence; rôle of metropolitan centers in national economy.

CONCRETE

Blocks. Find Solution to Low Cost Home. *Concrete*, vol. 46, no. 2, Feb. 1938, pp. 38 and 40. Description of cinder concrete units for suburban building; new type of block machine turns out units of exceptional quality at plant of Mahlstedt Materials, Inc.

Columns, Design. Plotting Column Steel Curves, J. R. Bole. *Eng. News-Rec.*, vol. 120, no. 7, Feb. 17, 1938, pp. 268–269. Procedure for designing reinforced concrete columns for combined bending and direct stress in accordance

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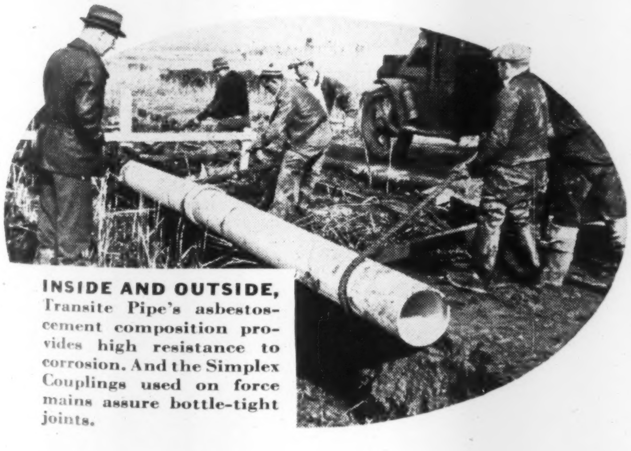

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with new American Concrete Institute building regulations; chart giving steel required in 20-in. square column subjected to direct loads and bending moments.

Construction. Improving Lock and Dam Concrete, J. L. Rohwedder. *Eng. News-Rec.*, vol. 120, no. 7, Feb. 17, 1938, pp. 262–264. Studies by U. S. Army Engineers for lock and dam construction on Mississippi River; formation of air bubbles and methods for their elimination; water separation in cements and sand streaking; use of higher water temperatures to increase strength of concrete placed under water; maximum size of aggregate and quantity of cement required to produce given workability; curing temperatures.

Construction, Forms. Form Construction on Kaw Valley Dike. *Concrete*, vol. 46, no. 2, Feb. 1938, pp. 3–6. System of steel forms especially designed for project permit use of ingenious methods of construction and full utility of equipment handled only by man power.

Construction, Joints. Test New Sheet Metal Dowel for Highway Joints, I. Lyse. *Concrete*, vol. 46, no. 3, Mar. 1938, pp. 3–4 and 34–35. Type of dowel investigated was made of sheet metal and pressed to size and shape required; dowels were welded to base plate forming single unit; samples tested were 3 and 4 in. deep and 8, 10, and 12 in. long; test methods and results obtained. Before Highway Research Board.

Construction, Testing. Determining Concrete Strength for Control of Concrete in Structures, B. G. Skramtajew. *Am. Concrete Inst.—J.*, vol. 9, no. 3, Jan.-Feb. 1938, pp. 285–303. Comparative review of fourteen methods of testing concrete in existing structures, including method of shooting bullets at structure, also methods requiring preliminary measurements when concrete is being placed.

Construction, Vacuum Process. Vacuum Concrete, W. F. Lockhardt. *Am. Concrete Inst.—J.*, vol. 9, no. 3, Jan.-Feb. 1938, pp. 305–319. Outline of vacuum concrete process of obtaining concrete with minimum water-cement ratio by removing unwanted mixing water from concrete, after it has been placed in forms, through agency of suction mats connected to vacuum pump; use on floor finish and wall construction; resurfacing concrete highways.

Design. Flat Slabs and Supporting Columns and Walls Designed as Indeterminate Structural Frames, H. D. Dewell and H. B. Hammill. *Am. Concrete Inst.—J.*, vol. 9, no. 3, Jan.-Feb. 1938, pp. 321–343. Theoretical study of practicability of treating flat slabs and their supporting columns and walls as indeterminate structural frames; moments in interior slabs and columns; moments in exterior slabs, wall columns, and first interior columns.

Retaining Walls. Concrete Retaining Walls Stop Earth Movements. *Concrete*, vol. 46, no. 3, Mar. 1938, pp. 5–6. Heights up to 51 ft above footings reached in gravity type walls as utilized in reconstruction and modernization of roadway in Morgantown, W.Va.

Sewage Tanks. New Precast Septic Tank Is Low in Cost. *Concrete*, vol. 46, no. 1, Jan. 1938, pp. 18–20. Description of precast concrete septic tank as developed by Division of Sanitary Engineering of Georgia State Board of Health.

Sewage Tanks. Special Rigs Speed Concreting on Circular Sewage Tanks. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, p. 338. Description of mechanical aids to concrete placement in construction of two circular, sloping-bottom sludge-digestion tanks on new Buffalo sewage-disposal plant; tanks are 90 ft in diameter, 20 ft high, with walls 12 in. thick; details of rotating truss screed for sloping bottoms and whirligig chute for wall placement.

DAMS

Concrete Arch, Stresses. Compte Rendu de l'étude des Procédés Photoélasticimétriques et leur Application aux Barrages-Voutes, V. Tesar. *Annales des Ponts et Chaussées*, vol. 107, no. 11, Nov. 1937, pp. 627–662. Report on photoelastic analysis of stresses in glass models of arch dams; changes in configuration of stresses in straight wall of constant section carrying eccentric vertical load, caused by appearance of horizontal cracks; experimental photoelastic study of stresses at fixed ends of thin arch.

Erosion. Erosioni di fondo a valle di uno scarico, A. Veronese. *Annali dei Lavori Pubblici*, vol. 75, no. 9, Sept. 1937, pp. 717–726. Results of experimental study, made at Hydraulic Laboratory of Royal University of Padua, Italy, on stream bed erosion below canal drops and overflow dams; derivation of empirical formulas.

FLOOD CONTROL

California. Southern California Coastal Plain Ravaged by Flood, N. A. Bowers. *Eng. News-Rec.*, vol. 120, no. 10, Mar. 10, 1938, pp. 349–351. News report on extraordinary catastrophic flood in Southern California, from Mar. 2 to 5, 1938.

Minnesota. Big Stone Lake Level Restored by Whetstone River Diversion. *Eng. News-Rec.*, vol. 120, no. 5, Feb. 3, 1938, p. 182. Description of WPA project costing $180,000, raising level of Big Stone Lake and effecting flood control for Minnesota River near Ortonville, Minn.

Texas. Major Texas Floods of 1936, T. Dalrymple and others. *U. S. Geol. Survey—Water-Supply Paper 816*, 1937, 146 pp., 25 cents. Rainfall and stream flow data on Texas floods of July and September 1936, including extremely high runoff rates based on slope-area determinations of flood discharges.

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Soils. Praktische Anwendung der Baugrunduntersuchungen, W. Loos. 3 ed. Berlin, Julius Springer, 1937. 204 pp., illus., diagrs., charts, tables, 18 rm. Treatise makes available results of researches on soil mechanics, especially as applicable to foundation work. Bibliography. Eng. Soc. Lib., N.Y.

HYDROELECTRIC POWER PLANTS

Dams, Geology. Engineering Geology of Passamaquoddy Project, I. B. Crosby. *Boston Soc. Civ. Engrs.—J.*, vol. 25, no. 1 (sec. 1), Jan. 1938, pp. 9–29. Results of geological investigation of site of tidal dams and reservoirs of abandoned Passamaquoddy tidal-electric power development.

HYDROLOGY AND METEOROLOGY

Erosion, Control. Terrace Project Planning, C. L. Hamilton. *Agric. Eng.*, vol. 18, no. 7, July 1937, pp. 315–317. Land use planning; developing terracing project; constructing terraces with 10-ft blade terracer and track-type tractor; field terrace systems. Before Am. Soc. Agric. Engrs.

Water Supply, Underground. Renewing Underground Water Supply, F. H. Tibbetts. *Eng. News-Rec.*, vol. 120, no. 10, Mar. 10, 1938, pp. 361–365. Data on operation of percolating areas in renewing underground supply of Santa Clara Valley, California; design for wire sausage dams that can be built for about $7 per lin ft; wire percolating dam on Guadalupe Creek; percolation reservoirs; off-channel percolation; progressive rise in average water table levels; results of replenishment program; rates of percolation in two large spreading areas.

Water Wells, New York. Record of Wells in Suffolk County, N.Y. N.Y. State Dept. Conservation—*Water Power & Control Commission Bul. GW-4*, 1938, 108 pp., supp. map. Drilling logs and other records of some 200 wells, Suffolk County, Long Island, N.Y.

INLAND WATERWAYS

Canals, Germany. Der Ausbau der Endstrecke des Oder-Spree-Kanals bei Fuerstenberg a.d., O. Ostmann. *Bautechnik*, vol. 15, nos. 33 and 35, July 30, 1937, pp. 429–433 and Aug. 13, pp. 452–455. Construction of terminal section of Oder-Spree-canal at Fuerstenberg-on-Oder, Germany, including levees, revetments, and jetties; description of drainage pumping plant; progress of construction; cost data.

IRRIGATION

Parks, Sewage Irrigation. Beautification and Irrigation of Golden Gate Park with Activated Sludge Effluent, C. G. Hyde. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 929–941. Experience with use of chlorinated plant effluent in westerly half of Golden Gate Park, San Francisco, for feeding of lakes and streams, also for irrigation from ditches and by sprinkling; activated-sludge sewage-treatment plant; volume, source, and character of sewage treated; proposed further development of salvaged sewage for park. Bibliography.

Water Supply, Underground. Capturing Water in Desert, R. O. C. Thompson. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, pp. 327–329. Construction of primitive water tunnels for tapping underground storage basins in India, for irrigation purposes.

LAND RECLAMATION AND DRAINAGE

Culverts, Design. Structural Design of Flexible Pipe Culverts, M. G. Spangler. *Pub. Roads*, vol. 18, no. 12, Feb. 1938, pp. 217–231. Principles of design of culverts based on elastic theory as applied to thin rings; culvert pipe tested in laboratory; theory of pressure distribution around flexible pipe culverts; formula for design of flexible culvert pipes; tests of four corrugated metal pipe culverts installed at Iowa Engineering Experiment Station field laboratory at Ames, Iowa; formulas for moment, thrust, and shear.

India. Land Drainage in Deccan Canal Areas, W. A. Evershed and C. C. Inglis. *Bombay Pub. Works Dept.—Tech. Paper*, no. 56, 1937, 74 pp. Review of irrigated lands drainage research and practice in Deccan area, India, including studies of soil and subsoils; subsoil water table, preparation of project, survey work; design of drains, alignments, and subsidiary works; construction and maintenance.

MATERIALS TESTING

Concrete. Effect of Type of Test Specimen and Gradation of Aggregate on Compressive Strength of Concrete, T. Gyengo. *Am. Concrete Inst.—J.*, vol. 9, no. 3, Jan.-Feb. 1938, pp. 269–282. Results of author's experiments with cubes, cylinders, and prisms to study effect of fineness modulus on relation between compressive strength, and size and shape of specimen.

PORTS AND MARITIME STRUCTURES

Quay Walls, Construction. New Quay at Lock Entrance, Albert Edward Dock, North Shields, R. B. Porter. *Concrete & Constr. Eng.*, vol. 33, no. 1, Jan. 1938, pp. 15–30. Design and construction of quay wall, 450 ft long, involving manufacture and driving of reinforced concrete piles 89 ft long, weighing 17 tons.

Quay Walls, Italy. Le nouveau Quai de l'Empire, prolongation du Quai des Esclavons, A. Venise, G. Tian. *Génie Civil*, vol. 112, no. 2893, Jan. 22, 1938, pp. 77–80. Design and construction of new Empire quay wall, 810 m long, along St. Mark canal, Venice, Italy; features of caissons 12.2 m deep, 8 m wide at base.

ROADS AND STREETS

Africa. Roads and Road Transport in Tanganyika Territory, W. H. McLuckie. *Instn. Civ. Engrs.—J.*, no. 8, Oct. 1937, pp. 572–574. Review of highway system of Tanganyika Territory in East Africa totaling 14,000 miles in length; construction and maintenance of roads; earth-road construction costs; highway and traffic laws; road transport.

Canada. Canadian Engineers Meet. *Eng. News-Rec.*, vol. 120, no. 7, Feb. 17, 1938, pp. 276–277. Proceedings of 1938 annual meeting of Engineering Institute of Canada, including abstracts of papers and discussions on superhighways, penstock construction, flood control, steam power generation, etc.

Design. Present Knowledge of Design of Flexible Pavements, A. C. Benkelman. *Pub. Roads*, vol. 18, no. 11, Jan. 1938, pp. 201–212. Review of existing data and discussion of needed research; methods used to stabilize soils; bearing capacity of soil; effect of size of loaded area on bearing capacity; variation in pressure under bearing plates of different rigidity; use of oscillating machine in study of pavements; effect of dynamic load; formulas for computing thickness of flexible pavements.

Design. Visibility, Signs and Guide Rails, A. L. S. Nash. *Can. Engr.*, vol. 73, no. 6, Aug. 10, 1937, pp. 11–14. Review of recent road-design practice, with special reference to reaction time at varying speeds, range of slight distances in relation to car speed, stop and warning signs, guard rails.

Maintenance and Repair. Ohio Starts Revamping Roads, K. L. Rothermund. *Eng. News-Rec.*, vol. 120, no. 11, Mar. 17, 1938, pp. 411–414. Ohio's $550,000,000 program of road renovation and improvement; types and costs of road widening and resurfacing.

Mississippi. Mississippi Highways. *Eng. News-Rec.*, vol. 120, no. 8, Feb. 24, 1938, pp. 293–296. Progress report on state-wide program of trunk highway construction inaugurated in 1936 with authorized expenditure of $42,500,000; relocations needed; towns by-passed; grading; side-roads; bridges; pavement types.

Planning. Evaluating Highway Extensions, C. B. McCullough. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, pp. 530–533. Outline of economic theory of highway planning in which solvency and desirability of road improvements are determined from vector addition of ratios of revenue and benefit to cost of proposed new work.

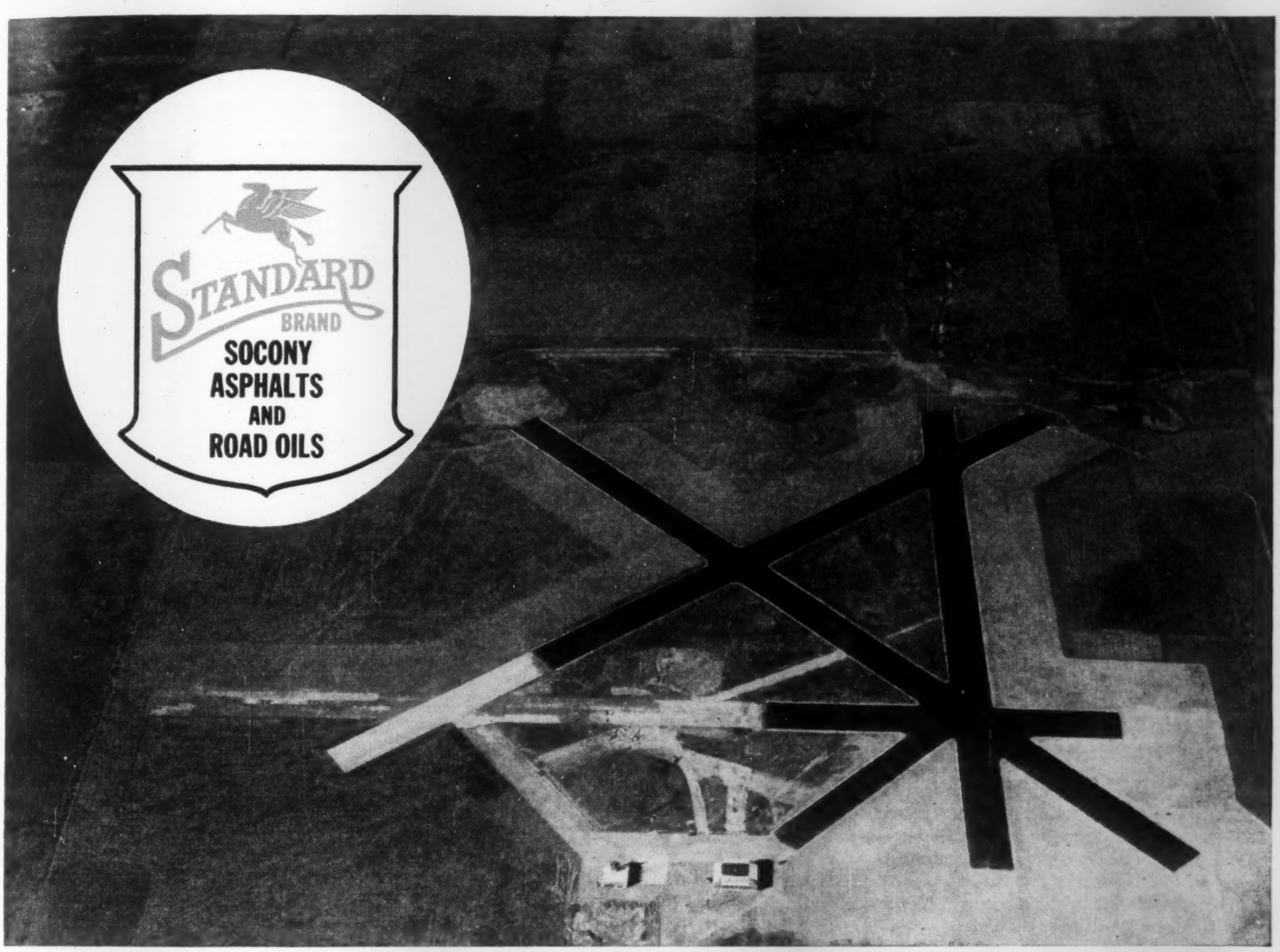
Swamps. Die Wirtschaftlichkeit des Moorsprengverfahrens, C. Usinger and A. Garras. *Forschungsarbeiten aus dem Strassenwesen—Bul.*, no. 4, 1937, 76 pp. Review of recent German experience with blasting methods for construction of road through swampy and other unstable formations; quantity of explosives used on several jobs.

SEWERAGE AND SEWAGE DISPOSAL

Accident Prevention, Sewage Disposal Plants. Hazards and Safety Measures at Sewage Works, L. W. Van Kleeck. *Mun. Sanitation*, vol. 8, nos 5, 6, 7, 8, and 9, May 1937, pp. 262–264; June, pp. 325 and 336; July, pp. 366–368; August, pp. 411–414; and September, 459–461. May: Hazards in operation of sewage disposal plants, pointing out remedial measures; prevention of

(*Continued on page 24*)

ANOTHER GOOD ROAD MADE BY GOOD ENGINEERING AND GOOD PRODUCTS



Socony Asphalt, Standard Brand, Niagara Falls Airport, N.Y.

Socony Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Socony Asphalt Emulsions • *Specifications and all other particulars furnished on request.*

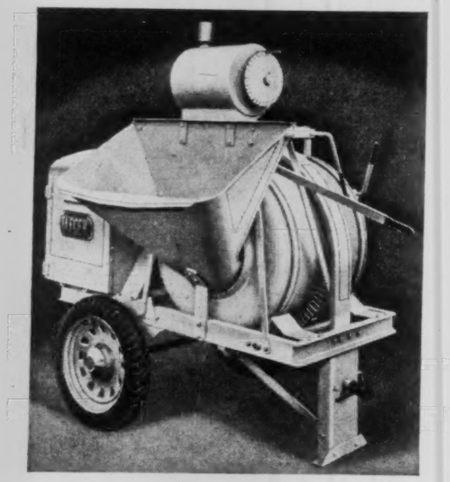
SOCONY-VACUUM OIL CO.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Concrete Mixer

LATEST ADDITION to the Jaeger Machine Company's line of concrete, mortar, plaster mixers is the light-weight "Handy"—a popular-priced non-tilt trailer said to have a capacity of 30 to 40 cu yds a day. This high capacity in a small mixer is due to the measuring basin hopper of same capacity as the drum, which may be loaded while the previous batch is being mixed and discharged.



Drum design is identical with that of larger Jaeger mixers, employing a criss-cross re-mixing action. Buckets are unusually large for fast discharge into forms or barrows. Chilled drum rollers operate on ball bearing shaft. Water tank is syphon type, of 7 gal capacity, with quick setting dial. All controls are grouped on side opposite from the $2\frac{1}{2}$ hp fully enclosed engine. Pneumatic tires, Timken bearings, spring shock absorbers, and disappearing towing pole equip mixer for trailing behind light cars.

The manufacturer stresses the fact that mixer's capacity is ample to meet the requirements of 70% of the jobs where concrete is used, whereas the cost is approximately one-half that of non-tilt mixers in the next larger size.

A New Closure

A SLIDING CHAIN link grille has been developed by Cornell Iron Works, Inc., Long Island City, N.Y. This grille is a flexible steel curtain of chain link mesh which is extended to any height of opening by vertical rods running to the supporting overhead track.

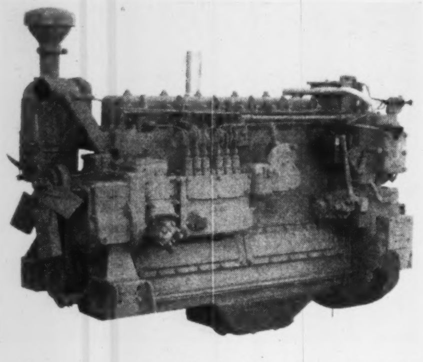
Because of its ingenious construction this Sliding Grille will nest in the space of one-sixth of opening width, or will turn a sharp curve to lie at a right angle to the opening. It can be made of galvanized wire, aluminum or stainless steel for application to factory building doors, store fronts, corridors or other locations where it is desirable to keep out intruders while allowing free circulation of air.

A New "Cat" Diesel

ADDING TO ITS LINE of industrial Diesel engines, Caterpillar Tractor Co. has announced a new, six-cylinder, 66 hp model, designed as the D-4600.

The new engine has a bore and stroke of $4\frac{1}{4} \times 5\frac{1}{2}$ in., and turns at 1,400 rpm, normal governed speed. The engine is of the four-stroke-cycle, valve in head, water cooled design, and features solid injection of the fuel into precombustion chambers. The fuel injection system is similar to that of all "Caterpillar" Diesels. Both the injection pumps and injection valves are set at the factory, and require no field adjustment.

In construction work, the new engine will power $\frac{3}{4}$ yd shovels and draglines. As a source of electric current, it will be offered as a unit with a 35 kw generator at 50 cycles at 1,500 rpm; or as a $32\frac{1}{2}$ kw generator at 60 cycles at 1,200 rpm. As a power unit, the D-4600 engine will meet many irrigation pumping demands, and will serve as standby power for smaller municipal pumping plants. On all these jobs, at rated load or 50 hp, the engine is reported to use not more than three gallons of low cost fuel an hour.



A 14 hp, two-cylinder gasoline starting engine is mounted at the rear of the Diesel, directly over the flywheel housing, having a governed speed of 3,000 rpm. For indoor installations, electrical starting is available.

Vari-Pitch Speed Changer

THE TEXROPE DIVISION, Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just put on the market a new speed changer unit which operates on the principle of that company's multi-groove Vari-Pitch Sheaves. The speed changer, designed with double shaft extensions and driven from a standard motor, provides the flexibility that makes it adaptable to a wide variety of layouts. The unit is provided with a hand wheel control, but can be equipped for electric remote control. The range of capacities now being offered include ratings up to 33 hp with ratios as high as $3\frac{3}{4}$ to 1. Larger ratings will be developed in the future. Bulletin 1266 gives all details.

New Cap Increases Safety in Blasting

ATLAS Manasite Blasting Caps and Electric Blasting Caps are announced by Atlas Powder Company as representing a real advance in safety for all users of explosives. The company points out that no detonator should properly be called "safe" as it is intended to set off explosives.

The new Manasite Detonators, however, substantially increase the margin of safety in handling explosives. These detonators contain a new initiating compound known chemically as hexanitromannite, and are much less sensitive to impact and friction than detonating compounds commonly used. Full detonating power and other advantages are maintained. Extensive field tests have proved the excellent performance and increased safety of Manasite Blasting Caps and Electric Blasting Caps.

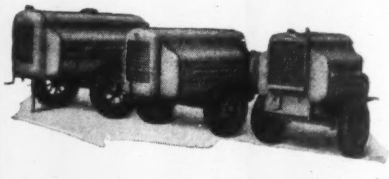
Concrete Vibrators

SYNTRON COMPANY, Homer City, Penna., have just brought out a new line of gas-engine driven internal concrete vibrators.

Each outfit is complete, made up of an engine, flexible shaft, and vibrating tool. The flexible shafts are available in 12 ft and 7 ft lengths, and the vibrating tools in two sizes. Vibration speeds range from 3,600 to 6,500 rpm. The complete catalog includes a treatise on the vibration of concrete.

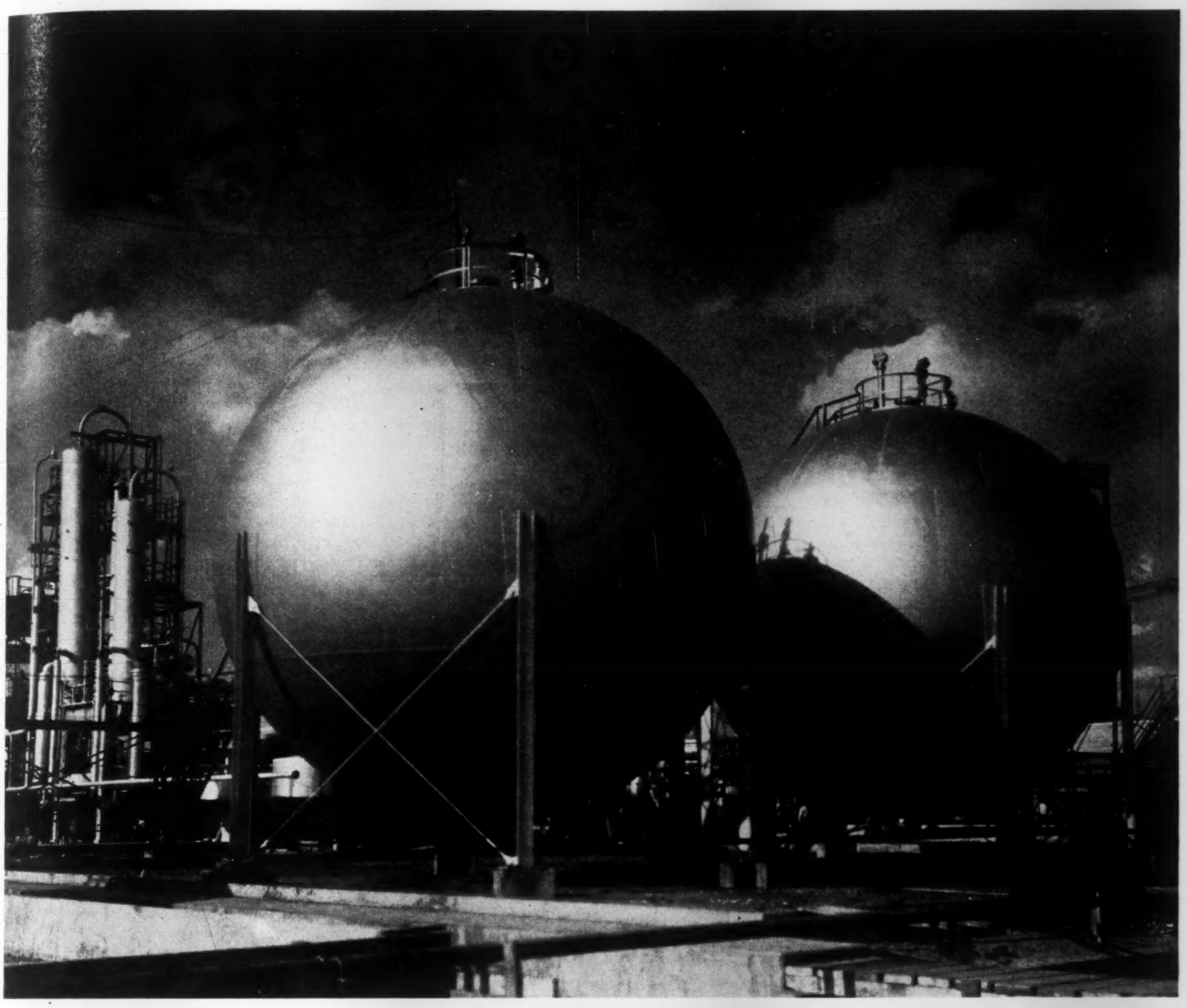
Light-weight Compressors

THREE NEW light-weight models in the Ingersoll-Rand line of air-cooled portable compressors have recently been announced. The smallest of these, the Model 55, delivers 55 cu ft of air per minute at 80 lbs pressure. The next larger, the Model 85A, delivers 85 cu ft of air per minute at 100 lbs pressure, and the largest, the 105-A, is rated at 105 cu ft of air per minute at 100 lbs pressure.



These compressors are designed for towing at speeds up to 35 miles per hr.

Models 85A and 105-A incorporate the I-R two-stage, air-cooled compressor and are furnished with either gasoline or oil engine. The Model 55 compressor (3 cylinder) is single-stage, air-cooled and driven by a gasoline engine. Detailed information is contained in bulletin 3264, available from Ingersoll-Rand Company, 11 Broadway, New York, N.Y.



Tanks Built to Outlive OBSOLESCENCE

When given the proper care and maintenance, steel tanks ordinarily have a life of thirty, forty or more years, depending on the service. In a growing number of instances, their useful life has been extended to such unusually long periods as seventy-five or eighty years. In spite of the longevity of the structures, all too many installations are made in which the type of tank built will be obsolete for that particular service in less than five years.

For instance, the volatility of gasoline and other oil products is constantly being stepped up. An ordinary tank installed today cannot be used to store the motor fuels of a few years hence without excessive evaporation losses.

The above illustration shows two 4,000-bbl. Hortonspheres used to store petroleum products. They are designed to withstand an internal pressure of 100 lbs. per sq. in. and will prevent all evaporation loss until the pressure exceeds that figure. Hortonspheroids are used to prevent evaporation losses from less volatile liquids where pressures up to 25 lbs. per sq. in. will meet present conditions and leave a margin of future changes in the character of the product stored.

Hortonspheres are built in capacities of 1,000 to 12,500 bbls. for pressures of 20 to 250 lbs. per sq. in. Standard capacities for Hortonspheroids range from 2,500 to 150,000 bbls. for pressures of 1 to 25 lbs. per sq. in. Write our nearest office for information or quotations.

CHICAGO BRIDGE & IRON COMPANY

Chicago..............2199 Old Colony Bldg.
Detroit..............1541 LaFayette Bldg.
Cleveland............2263 Rockefeller Bldg.
New York........3395—165 Broadway Bldg.

Boston.........1545 Consolidated Gas Bldg.
Philadelphia........1652-1700 Walnut Street
Dallas.............1485 Liberty Bank Bldg.
Houston..................2919 Main Street

Tulsa......................1647 Hunt Bldg.
Birmingham............1596 N. 50th Street
San Francisco.............1084 Rialto Bldg.
Los Angeles.............1456 Wm. Fox Bldg.

B-574

PLANTS in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Blueprint Papers

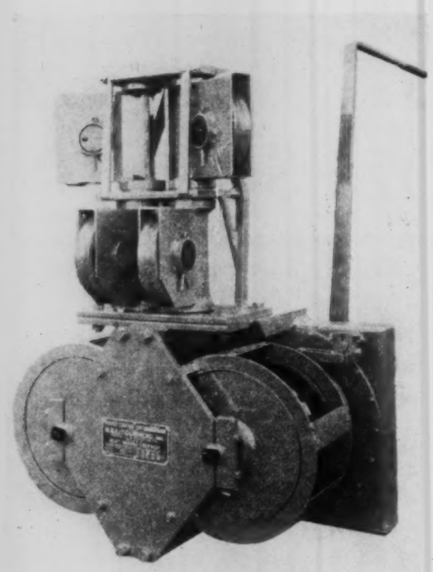
BLUEPRINT PAPERS of a radically new type have been announced by Keuffel & Esser Co. of Hoboken, N.J. The improved papers are named "Series Sixty," and they are said to produce prints of an unusually deep blue color, so that the white lines of the reproductions stand out in sharp, legible contrast.

An exceptionally wide printing range is also claimed for Series Sixty Blueprint Papers. Tracings of varying transparency can be printed successfully at a single setting of the machine—or strong blueprints can be made from any tracing within a broad range of machine speeds. This extra margin of printing range reduces the danger of over exposure and under exposure, eliminates the necessity for "trial prints" and speeds production.

Unlike ordinary blueprint papers, Series Sixty Papers are light blue instead of yellow before they are exposed to light. They are handled the same as conventional papers—printed and washed with the same equipment and procedure. The advantages of Series Sixty Papers are described in detail in a new twelve-page booklet, containing 18 illustrations, diagrams, and charts.

New Power Control Unit

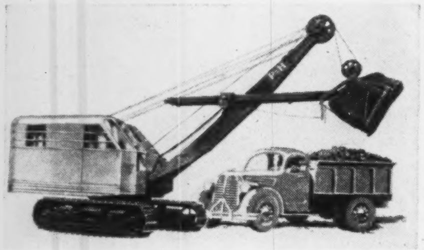
DESIGNED for extreme ruggedness and efficient operation of cable controlled heavy grading equipment, a new Double-Drum Power Control Unit has been placed on the market by R. G. Le Tourneau, Inc., Peoria, Ill. The new unit, designated as Model R8 and for use on "Caterpillar" D8 tractors, incorporates a number of improved features.



The gear reduction ratio has been lowered, the line speed is reduced, and line pull (with empty drum) is increased to 9,600 lbs. The range of the unit is increased by a cable capacity of 255 feet of $^{1}/_{2}$ in. 6 × 19 cable on each drum. To insure more positive braking, the area of the brake has been increased over 40%, and an improved braking mechanism permits the application of more pressure per square inch to the drum.

Convertible Excavator

HARNISHFEGER CORPORATION of Milwaukee announces its new $^{3}/_{4}$-yd fully convertible machine, Model 255, which completes the line of P&H Pacemakers, from $^{3}/_{8}$ to 5 cu yds capacities. Throughout its construction the 255 employs the use of rolled alloy steels and P&H all-welded design to gain the advantages of greater strength combined with less weight.



Husky box sections rigidly welded to the circular lower carbody combine with the crawler frames to make a single-piece lower frame. The upper revolving frame is a single-piece all-welded unit, built of alloy steels, and machined as a unit for perfect alignment of all working parts.

The P&H High Leverage Drive employed is reported to result in increased life of brake and clutch linings. This drive is arranged so that the clutches and brakes exert a high leverage on the actual load when driving all the operating parts of the machine. Hoist and digging drums are of ample size to accommodate the amount of cable required for operating with a 40-ft boom without overlapping on the drum.

The P&H Model 255 is equipped with three-speed transmission, with a chain drive operating the self-cleaning tractor-type crawlers. Other modern features are: a truss-type gantry; a live roller circle; double equalized hook rollers; compensator springs for the crawler track; flexible drive shaft; and "live" type boom with chain crowd. Further information may be obtained from Harnishfeger Corporation, 4400 W. National Ave., Milwaukee, Wis.

Field Lubrication

THE ALEMITE DIVISION of the Stewart-Warner Corporation has announced the completed development of a time-saving "portable service station," designed for power lubrication of tractors and other heavy machinery on the job. Tests on the proving grounds of one of the largest tractor manufacturers indicate that this new service equipment makes lubrication possible in approximately one-third of the time involved in the hand method.

The new Alemite equipment is designed for mounting with a gasoline driven air compressor on a pick-up truck or trailer. It consists of pumps, hose and control valves for handling high pressure lubricant, gear lubricant and motor oil direct from original 400 lb barrels. Automatic controls maintain a normal air pressure of 150 lbs in the storage tank. High pressure lubricant is delivered at a pressure of approximately 30 times the pressure in the air storage tank. Both the gear lubricant and the motor oil are delivered at pressures of approximately eight times the air pressure.

Folders Announced

BUCKETS, CLAMSHELL—Bulletin 1606—"Buckets for Contractors," describes a reliable method for selection of the proper bucket for a given purpose, explaining the relation of crane capacity, clearances, etc., to the type of work to be done. Blaw-Knox Company, Pittsburgh, Penna.

CORE DRILLS—A new 42-page catalog, No. 9501-A, is available on the complete line of Calyx Core drills, designed for boring holes in rock and concrete in sizes from $2^{1}/_{4}$ in. to 72 in. in diameter, and depths of 2,500 ft. Ingersoll-Rand Company, 11 Broadway, New York, N.Y.

DERRICKS—A new 24-page catalog, D-1, covers the guy, stiffleg, barge and erectors' derricks of American Hoist & Derrick Co., St. Paul, Minn.

ELECTRIC FURNACE—The salient features of the Heroult Electric Furnace; efficiency of operation, safety, sensitivity of control, rapidity of melt, low operating cost, etc., are concisely described and fully illustrated in a 24-page, $8^{1}/_{2}$ × 11 in. book. American Bridge Co., Frick Bldg., Pittsburgh, Penna.

ENAMELS FOR PIPE LINES—The applications and uses of Barrett Enamels are pictured and tersely described in a 36-page booklet entitled "Water Works Protection." Barrett Co., 40 Rector St., New York, N.Y.

EXCAVATOR—A new, 32-page illustrated bulletin tells the complete story of the Bucyrus-Erie 29-B, with complete specifications which give all working ranges and crane ratings. Bucyrus-Erie Co., South Milwaukee, Wis.

HIGHWAY GUARD RAIL—A 4-page folder describes the cable guard rail and illustrates the ease of assembly. Bethlehem Steel Co., Bethlehem, Penna.

LIGHTING HANDBOOK—A completely revised edition of its lighting handbook, titled "Artificial Light and its Applications," is available at 75¢ a copy; 258 pages, $8^{1}/_{2}$ × 11 in. Westinghouse Lamp Division of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penna.

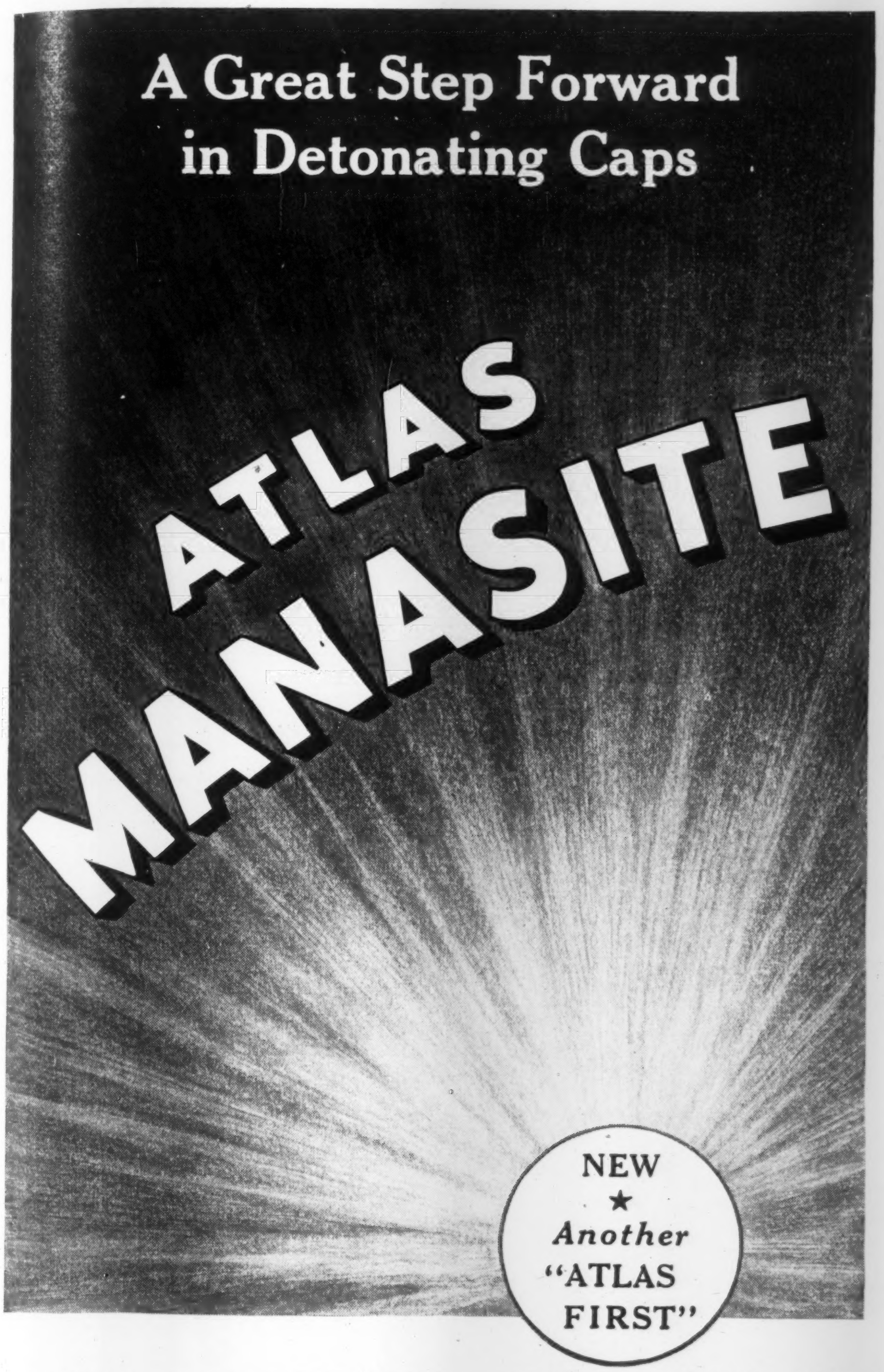
MONEL GASKETS, PARTS AND TRIM—An 8-page booklet, entitled "New Life for Old Equipment," describes the use of Monel Metal for these services. The International Nickel Co., Inc., 67 Wall St., New York, N.Y.

MONEL AND NICKEL—"6 Minutes with 6 Metals" is the title of a pocket-size booklet that is a quick guide to the characteristics and uses of the metals and alloys of The International Nickel Co., 67 Wall St., New York, N.Y.

SAND EXPANSION INDICATOR—Bulletin No. 60 covers the gauge developed to measure the sand expansion occurring in filter washing. Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia, Penna.

ROAD JOINTS—A new one-piece, easily-set road joint which provides permanently correct placement of all dowels and a durable sealing of bottom and end of the joint is described in a 4-page folder. Bethlehem Steel Co., Bethlehem, Penna.

ROLLING DOORS—A 24-page illustrated catalog describes the full line of doors and door products of Kinnear Manufacturing Co., Columbus, Ohio.



GREATER
Safety

Inasmuch as a blasting cap is designed and intended to set off high explosives . . . no blasting cap can ever be called absolutely safe.

The new Atlas Manasite Blasting Cap, however, gives the user of explosives a much greater margin of safety than is possible with any detonating cap in common use.

Atlas Research determined to produce a blasting cap much less sensitive to external shock or impact. Success has now been attained in the use of nitromannite as an initiating compound.

Careful tests indicate a substantial reduction in sensitivity to impact and friction. This means definitely greater safety in handling for the worker with explosives.

Atlas Manasite is an exclusive Atlas development.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

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Everything for Blasting

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Pittsburgh, Pa.
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UNION METAL PILE SHELLS DON'T REQUIRE IMMEDIATE FILLING
EVERY HAMMER BLOW COUNTS

● Union Metal Fluted Steel Pile Shells are more than strong enough to withstand surrounding ground pressures. All piles in one foundation section can be driven prior to inspection and filling with concrete, regardless of the time involved. This feature makes possible a more economical pouring operation. It also avoids possible ruptures during the initial setting of the concrete which may be caused by adjacent driving vibrations.

This is but one of the many advantages of Union Metal Pile Shells that enable you to install quality cast-in-place concrete piles for less money. Write today for catalog containing the complete story.

THE UNION METAL MANUFACTURING CO.
Canton, Ohio

(*Continued from page 18*)

physical injuries. June: Prevention of infection. July: Gas and fume dangers. August: Safety equipment for gas and fumes; companies selling approved safety equipment. September: Fire and explosion prevention; instructions for chlorine poisoning.

CONCRETE. Relief Sewer Ends River Pollution, T. A. Berrigan. *Eng. News-Rec.*, vol. 120, no. 4, Jan. 27, 1938, pp. 140–142. Construction features of $2,600,000 sewer, 3 to 8.5 ft in diameter, designed to eliminate overloading of system which disgorged through manholes and polluted Aberjona River in Boston Metropolitan District; construction methods; special pipe joints.

DISPOSAL PLANTS, MIDDLETOWN, CONN. Sewage Disposal at Middletown, T. F. Bowe. *Eng. News-Rec.*, vol. 119, no. 26, Dec. 23, 1937, pp. 1011–1015. Design and construction of new 3-mgd sewage disposal plant of Middletown, Conn., featuring sedimentation, separate sludge digestion in rectangular tanks, vacuum dewatering, and incineration in multiple-hearth furnace; construction of pumping station and 3.5 miles of interceptors; details of rectangular sludge-digestion tanks and gas-storage tank with capacity of 2,650 cu ft; operating results.

DISPOSAL PLANTS, MINNEAPOLIS-ST. PAUL. Layout and Plan of Operation of Minneapolis-St. Paul Sewage Treatment Plant, G. J. Schroepfer. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 913–928. Description of 134-mgd new sewage-disposal plant; degree of treatment; detailed description of various units; sewage treatment; sludge disposal; laboratory and administration building; costs.

DISPOSAL PLANTS, SIOUX FALLS, S.DAK. Packing House Waste and Sewage Treatment at Sioux Falls, South Dakota, R. E. Bragstad and L. Bradney. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 959–969. Description of renovated plant for disposal of sewage from population of 35,000 plus industrial wastes from meat packing plants and stockyards with population equivalent of 103,000; features of plant combining chemical treatment, trickling filters, and activated sludge processes; performance records of plant.

INDUSTRIAL WASTES. Sewage Treatment and Industrial Wastes in Fox River Valley, S. A. Greeley and J. W. Nemoyer. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 1024–1032. Survey of water pollution and methods of control on 38-mile waterway in Wisconsin.

INDUSTRIAL WASTES. Survey of Recent Developments in Treatment of Industrial Wastes, W. Rudolfs. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 998–1014, (discussion) 1014–1018. Survey of information available for period September 1934 to August 1937; trade waste surveys made in connection with stream pollution; gas and phenol wastes; dairy, brewery, distillery, tannery, meat packing, cannery, and sugar wastes; oil, grease, and laundry wastes; textile, dye, paper, and alcohol wastes; mine wastes; pickling liquors. Bibliography.

LABORATORY CONTROL. Laboratory Control of Sewage Treatment—VIII, IX, and X, F. W. Gilcreas. *Mun. Sanitation*, vol. 8, nos. 3, 4, and 5, Mar. 1937, pp. 188–189; Apr., pp. 226–227; and May, pp. 279–280. March: Fundamentals of bacteriology of sewage treatment; characteristics of various bacteria; bacteriological examination; sampling technique and interpretation. April: Biology of sewage; trickling filters; stream purification; microscopic examination. May: Chemical treatment of sewage; plant laboratory.

MAINTENANCE AND REPAIR. Sewer Stoppages Cut 90 Per Cent. *Eng. News-Rec.*, vol. 120, no. 10, Mar. 10, 1938, p. 370. Improvement in maintaining Los Angeles sewers, particularly with references to stoppages, resulted from adoption of plan for continuous, routine inspection instead of attention only when trouble was reported.

PLANTS, MANAGEMENT. Rationalisation of Sewage Disposal, C. B. Townend. *Surveyor*, vol. 92, no. 2374, July 23, 1937, pp. 99–101. British view of deficiencies of present system of administration of sewage disposal; advantages of regional control; centralization; future administration; suggested legislation. Before 1937 Roy. Sanitary Inst. Health Congress.

SEWAGE DISPOSAL. Modern Trends in Sewage Disposal, S. G. Wardley and J. A. Christian. *Instn. Mun. & County Engrs.—J.*, vol. 64, no. 3, Aug. 3, 1937, pp. 213–237, (discussion) 238–246. Principles and ideas underlying modern practice; origin of biological processes; self purification; reoxygenation of water; conditions determining necessity for sewage treatment; disposal by dilution, with or without pretreatment; chemical treatment; complete treatment of sewage; processes auxiliary to treatment of sewage; application of chlorination at Leicester.

SEWAGE DISPOSAL, RESEARCH. Practical Value of Sewage Research, W. Rudolfs. *Mun. Sanitation*, vol. 8, no. 10, Oct. 1937, pp. 509–511. Review of half century of sewage treatment progress; basic research; advances in sewage chlorination, sludge digestion, drying and disposal, sewage filtration and oxidation, and chemical treatment.

SEWAGE DISPOSAL, TEXAS. Sewage Disposa—Its Effects Upon Public Health, G. W. Cox and V. M. Ehlers. *Mun. Sanitation*, vol. 8, no. 10, Oct. 1937, pp. 498–501. Relationship between sewage pollution and incidence of disease; Texas problems of mass hygiene; 1866 Galveston epidemic; typhoid deaths in Texas; growth in sewerage systems; oil companies' action to protect employees.

SLUDGE DIGESTION. Rechengut- und Schlammfaulversuche, J. Lesenyei. *Gesundheits-Ingenieur*, vol. 60, no. 48, Nov. 27, 1937, pp. 731–733; see also brief English abstract in *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, p. 346. Original experimental study by Sewage Laboratory of Budapest, Hungary, on use of rotted leaf mold as seed materials to start digesters, when no other material is available; variations in gas production.

TANKS, CONCRETE. New Precast Septic Tank Is Low in Cost. *Concrete*, vol. 46, no. 1, Jan. 1938, pp. 18–20. Description of precast concrete septic tank as developed by Division of Sanitary Engineering of Georgia State Board of Health.

WASTE UTILIZATION. Salvage from Sewage? W. Rudolfs. *Eng. News-Rec.*, vol. 119, no. 27, Dec. 30, 1937, pp. 1055–1057. Discussion of possible change in trend of sewage disposal to emphasize possibilities of by-product recovery; extent of present utilization of by-products and possibilities of producing others.

WASTE UTILIZATION. Utilization of Sewage Sludge as Fertilizer. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 861–912. Report of Committee on Sewage Disposal, American Public Health Association, discussing measure of fertilizer values; changes in composition of mixed fertilizers; tonnage of sludge in United States; fertilizing value of sludge; comparison of digested sludge with farm manure; history of sludge as fertilizer; utilization of activated sludge hygienic aspects. Bibliography.

WASTE UTILIZATION, PAPER AND PULP MILLS. Utilization and Disposal of Sulfite Waste Liquor, K. A. Kobe. *Sewage Works J.*, vol. 9, no. 6, Nov. 1937, pp. 1019–1023. Characteristics of paper mill wastes; waste flow and pollution value of pulp and paper mills; composition of sulfite waste liquor; ponding and aeration; fermentation; evaporation; precipitation methods. Bibliography.

STRUCTURAL ENGINEERING

ANTI-AIRCRAFT PROTECTION. Gewoelbe im Schutzraumbau, Fiebig. *Deutsche Bauzeitung*, vol. 72, no. 4, Jan. 26, 1938, pp. B82–B85. Use of concrete and masonry arches in construction of roofs for anti-aircraft bomb-proof shelters; numerical examples.

DESIGN. Modern Methods of Structural Design, J. F. Baker. *Instn: Civ. Engrs.—J.*, no. 8, Oct. 1937, pp. 297–324. Lecture reviewing new ideas in structural design, with special reference to frame structures, use of structural models, etc.

DESIGN. Shearing Deformation in Continuous Beams and Rigid Frames, A. Floris. *Am. Concrete Inst.—J.*, vol. 9, no. 2, November-December, 1937, pp. 165–192. Theoretical mathematical discussion leading to modification of slope deflection and moment distribution methods used in deformation analysis of continuous beams and rigid frames, by including influence of shearing forces; numerical examples.

INFLUENCE LINES. Influence Lines by Moment Distribution, F. Kruys. *Eng. News-Rec.*, vol. 120, no. 3, Jan. 20, 1938, pp. 112–113. Simple modification of Hardy Cross method giving necessary influence line ordinates and requiring only two distributions for member.

MODELS. Model Analysis of Structures, J. B. Wilbur. *Boston Soc. Civ. Engrs.—J.*, vol. 25, no. 1 (sec. 1), Jan. 1938, pp. 30–40. Theoretical mathematical discussion of direct and indirect methods of analysis of structural models.

STRESSES. Interpreting Data from Strain Rosettes, G. E. Beggs and E. K. Timby. *Eng. News-Rec.*, vol. 120, no. 10, Mar. 10, 1938, pp. 366–370. Determination of principal stresses and strains on plate subjected to strain in two dimensions by taking tensometer measurements on rosettes of intersecting gage lines; mathematical theory of strain rosette measurements; form for recording data.

TOWERS, CONSTRUCTION. Tower Reconstruction Completed, R. F. Egelhoff. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, pp. 334–336. Completion of tower of Boston's new Old South Church to roof peak 220 ft above street level; novel scaffolding devised; plant layout designed to utilize limited space available for construction.

TRUSSES, VIERENDEEL. Practical Method of Calculation for Vierendeel Truss Bridges, F. Takabeya. *Hokkaido Imperial Univ.—Faculty Eng.—Memoirs*, vol. 4, no. 2, Dec. 1937, pp. 29–74. Application of mechanical-tabulation method and slope-distribution method to analysis of Vierendeel trusses of parallel chords; application of X-distribution method for analysis of Vieren-

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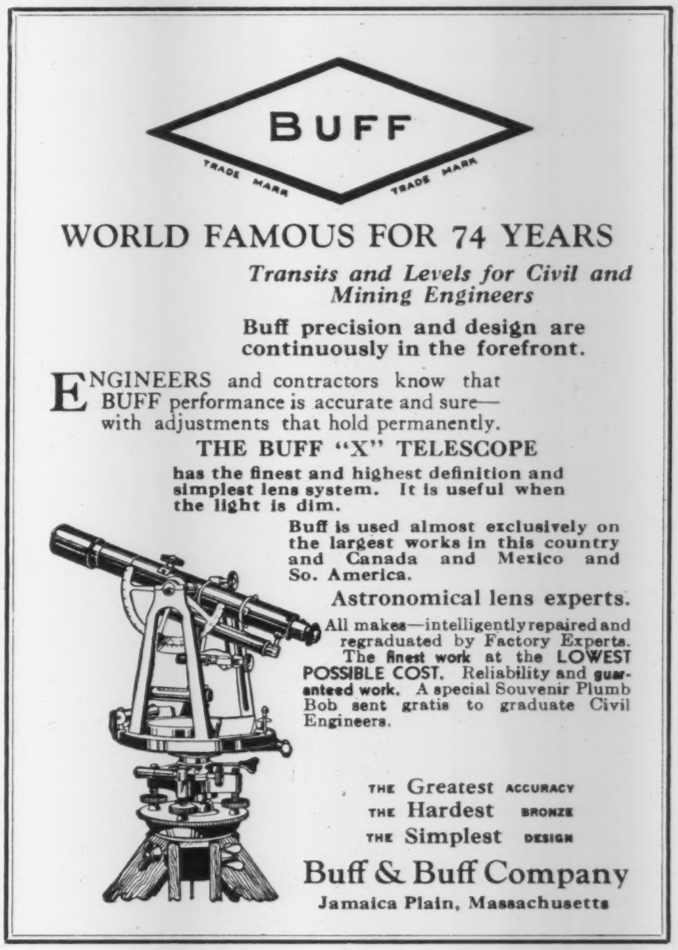

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TUNNELS

Lighting. Light Gradation in Tunnel Approach. *Eng. News-Rec.*, vol. 120, no. 7, Feb. 17, 1938, pp. 259–261. Design of transition from artificial illumination to daylight to avoid motorists' momentary blindness in Broadway vehicular tunnel, recently completed between Oakland, Calif., and Contra Costa County; blower arrangements.

Subways, France. L'etat Actuel du réseau du chemin de fer Métropolitain de Paris, et les travaux recemment exécutés, G. Bardout. *Génie Civil*, vol. 112, nos. 2890, 2891, and 2892, Jan. 1, 1938, pp. 1–7; Jan. 8, pp. 36–39; and Jan. 15, pp. 57–59. Present status of Paris metropolitan subway system with special reference to recently completed extensions, including new stations; methods of tunnel driving.

WATER TREATMENT

California. California Water Treatment Practice, C. Wilson. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 379–380. Discussion of trends of California water-treatment practice, with special reference to surface-water treatment, odor and taste control, and increased reservoir control.

Distribution Systems, Design. Analyzing Flow in Pipe Networks, G. M. Fair. *Eng. News-Rec.*, vol. 120, no. 9, Mar. 3, 1938, pp. 342–343. Original simplified approach to application of Hardy Cross method of computing flow distribution and variation of head in various parts of pipe network; numerical examples.

Sedimentation. Dynamics of Sedimentation, J. J. Slade, Jr. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1790–1796, (discussion) 1796–1802. Theoretical mathematical study of settling of solids through turbulent viscous fluid; dynamical theory of sedimentation; turbulent sedimentation; experimental determination of turbulent velocity; sedimentation formula. Bibliography.

Softening. Review of Lime-Soda Water Softening, C. P. Hoover. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1687–1696. Historical review of development of lime-soda water softening processes in United States since beginning of twentieth century; improvements and advancements in handling and application of chemicals; mixing tanks; settling basins; lime sludge; overcoming limitations of lime-soda process; split treatment; substituting zeolite for soda-ash; treatment of flood water; recarbonation.

Softening, Sarasota, Fla. Sarasota's Automatic Sea Water Regeneration Zeolite Water Softening Plant, C. E. Richheimer. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1712–1721. Review of problems confronting City of Sarasota, Fla., in its endeavor to obtain adequate and dependable supply of potable soft water; designing and constructing automatic zeolite water-softening plant for regeneration of sea water; raw water investigation; softening plant investigation; cost estimates of softening plant.

Softening, Zeolite Process. Trends in Zeolite Softening, S. T. Powell. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1722–1738. Review of recent trends in zeolite softening of municipal water supplies; partial list of zeolite softening plants in United States; relative merits of lime-soda and zeolite softening; softening; acceptable hardness of municipal water supplies; types of zeolite; effect of zeolite softening on industrial water supplies; cost of zeolite systems.

WATER WORKS ENGINEERING

Coagulation. Coagulation Aided by Silicates, J. R. Baylis. *Water Works Eng.*, vol. 90, nos. 14 and 15, July 7, 1937, pp. 971–974, and July 21, pp. 1935–1939. July 7: In experiments at Chicago experimental filtration plant addition of silicates greatly improved floc formation, but study of each water must be made to determine value of silicates. July 21: Fact that silica is not coagulant is set forth together with amount of silica to be used, its preparation and necessity of acid treatment. Bibliography. Before Am. Water Works Assn. (To be continued.)

Cold Weather Operation. Winter Protection of Water-Works Plants. *Am. City*, vol. 52, no. 11, Nov. 1937, pp. 81, 83, and 85. Instructions for care of plant and equipment for protection against damage due to low temperature.

Denver, Colo. Trans-Mountain Water Diversion for Denver, A. A. Matthews. *Am. City*, vol. 52, no. 11, Nov. 1937, pp. 58–60. Description of new extension of water works of Denver, Colo., including development of Moffat water tunnel, with ultimate capacity of 1,250 cu ft per sec, diverting water from western slope beyond Divide; collection system; flow from tunnel to Denver; filtration and distribution.

Exhibitions, San Francisco. Pumps and Pipes Serve Three Objectives, A. P. Malley. *Eng. News-Rec.*, vol. 119, no. 27, Dec. 30, 1937, pp. 1050–1052. Description of water supply for new island in San Francisco Bay planned for large exposition requirements and later for smaller airport demand and fire protection; comparison of first and operating costs for three pipe diameters; factors affecting cost; sizes and capacities of pumping equipment; operating program.

Fluoride Removal. Removal of Fluorides from Potable Water by Tricalcium Phosphate, H. Adler, G. Klein, and F. K. Lindsay. *Indus. & Eng. Chem.*, vol. 30, no. 2, Feb. 1938, pp. 163–165. Observations of gel structure during process of manufacture suggested use as adsorbent; test towers used to prove effectiveness of granular tricalcium phosphate for treating natural fluoride-bearing waters and synthetic waters; effect of particle size on capacity; effect of fluoride concentration, pH, and total hardness fluoride ratio; field tests verify results. Bibliography.

Great Britain. West Hampshire Water Supply, D. Llewellyn. *Water & Water Eng.*, vol. 39, no. 482, Aug. 1937, pp. 451–456. Description of new works of West Hampshire Water Company, serving territory of 225 sq miles, including borough of Christchurch; features of new low-lift pumping station of 17-mgd capacity; hydraulic tubrine station; high-lift engine house; preliminary or roughing filter house; chloramine treatment; pumps.

Meters, Testing. Meter Testing Methods and Program of East Bay Utility District, T. I. Casey and J. S. Stevens. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 385–387. Water meter testing practice of East Bay Municipal Utility District, California; examining, checking, and repairing of meters; testing new meters; gear ratio slide rule developed to simplify correction of meter gear ratio.

Montreal. Historical Background and Important Features of Montreal Water Works, C. J. Desbaillets. *Eng. & Contract Rec.*, vol. 50, no. 68, Apr. 14, 1937, pp. 14–23. History since 1800 and description of Montreal water works at present time; filtration works; low-lift pumping stations; laboratory; sterilization equipment; new McTavish pumping station; reservoirs; trunk mains; operation costs.

New Brunswick. Water Supply of St. Stephen, N. B., Is Unique in Providing International Service, A. A. Laflin. *Eng. & Contract Rec.*, vol. 50, no. 73, May 19, 1937, pp. 9–12; see also *Canadian Engr.*, vol. 72, no. 25, June 22, 1937, pp. 5–7. Description of joint well-water supply for St. Stephen and Milltown in province of New Brunswick, and Calais, in Maine, with total population of about 11,000; two reservoirs, one at each end of system, guard against interruption; pumping equipment.

Supply, Expositions. Supplying Water to Exposition, C. H. Lee. *Water Works Eng.*, vol. 90, no. 14, July 7, 1937, pp. 968–970. Design of water-supply system for Golden Gate exposition in San Francisco, Calif., involving pumping from San Francisco system through pipe line on bridge to distributing reservoir 260 ft above San Francisco Bay; fire protection system; emergency salt-water supply; sewer system.

Supply, Hygiene. Water-Borne Outbreaks in United States and Canada 1930–1936 and Their Significance. *Am. Pub. Health Assn.—Year Book 1937–1938* (Supp. to *Am. J. Pub. Health*, vol. 28, no. 2, Feb. 1938), pp. 137–156. Statistical data on water-borne outbreaks in United States and Canada, 1930–1936; chronology of outbreaks and weather; distribution of outbreaks and cases by regions, seasons, and population groups; points of pollution in water system; classification of outbreaks and cases as to causes; largest water-borne outbreaks; multiple cases in same community.

Tanks and Towers. Elevated Tank Design New to West Used in 500,000-Gal. Unit at Fresno, L. A. Elsener. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 390–391. Design and architectural treatment of new 500,000-gal steel water tank at Fresno, Calif., featuring radial cone bottom, tubular columns, and combination of welding and riveting; details of radial girder design.

Tanks and Towers, Sacramento, Calif. Elevated Concrete Tanks of Record Capacity Built for Sacramento Water Department. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 376–378. Design and construction of two largest reinforced concrete elevated tanks on record, each with capacity of 3,000,000 gal, recently completed at Sacramento, Calif.; features are concrete floor slab, welded steel shell, and timber roof; suspended slab introduced between exterior wall and first circle of columns; roof support system.

United States. Progress and Developments in Dams, Supply Lines and Pumping Equipment, L. R. Howson. *Am. Water Works Assn.—J.*, vol. 29, no. 10, Oct. 1937, pp. 1429–1437. Review of 1936–1937 progress in construction of dams and water supply lines in the United States; Los Angeles aqueduct; Denver contract; pumps.

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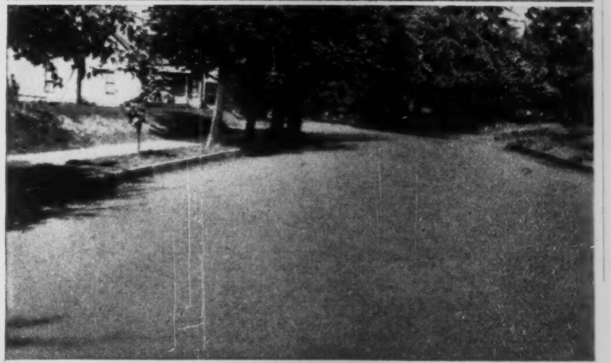

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BRIDGES

Caissons, Steel, Welded. Welded Foundation for Bronx-Whitestone Bridge, C. H. Scott. *Welding J.* (N.Y.), vol. 17, no. 4, Apr. 1938, p. 19. Description of welded caissons and cutting edges; two large cutting edges are 100 ft long by 38 ft wide; in addition there were two 38-ft diameter cutting edges; these were formed in sections, erected on man-made islands and welded in field.

Concrete, Washington. Hollow Girder Design Used for Bridge at Aberdeen, S. C. Watkins. *Western Construction News,* vol. 12, no. 11, Nov. 1937, pp. 450–452. Design and construction of new concrete bridge at Aberdeen, Wash., consisting of 4 spans of 73 ft and 2 cantilevers of 26 ft, totaling 344 ft, employing hollow cellular construction of both girders and columns; tabulation of bids; Hesnager hinges used; no expansion joints in deck.

Floors. Roadways on Bridges, E. W. Bowden. *Eng. News-Rec.,* vol. 120, no. 12, Mar. 24, 1938, pp. 442–444. Bridge roadway design trends during past decade; anchorage of concrete slabs to floor steel; expansion joints; drainage provisions; operation and maintenance; Triborough Bridge curb design.

Piers, Foundations. Baugrundforschung bei bruecken der eisenbahn Heydebreck-Gr.-Strehlitz, M. Roloff and J. Ehrenberg. *Bautechnik,* vol. 15, no. 40/41, Sept. 17, 1937, pp. 501–517. Equipment and methods used in testing foundations for piers and abutments of several minor bridges on Heydebreck—Gr. Strehlitz railroad line, Germany; loading and settlement curves; shear resistance of ground with reference to its moisture content; failure of concrete culvert structures.

Plate Girder, Quebec. Ste. Anne de la Perade Bridge P. G. A. Brault. *Eng. J.,* vol. 21, no. 4, Apr. 1938, pp. 173–180. Design, fabrication, and erection of new all-welded steel highway bridge over Ste. Anne River, at Ste. Anne de la Perade, Quebec; bridge is six-span continuous deck-plate girder 644 ft long, carrying 24-ft concrete roadway, and two 5-ft concrete sidewalks; difficulties encountered due to exceptional spring floods during construction. Before Eng. Inst. Canada.

Steel Truss, Brisbane River Bridge, J. J. C. Bradfield. *Commonwealth Engr.,* vol. 25, no. 4, Nov. 1, 1937, pp. 129–131. Features of new steel-truss bridge being constructed at Brisbane, Australia, having main span of 924 ft; total length 4,513 ft; roadway, 60 ft plus two 10-ft footways.

Steel Truss, Sarnia-Port Huron. Sarnia-Port Huron International Highway Bridge, P. L. Pratley. *Can. Eng.,* vol. 73, no. 8, Aug. 24, 1937, p. 11. Main features of steel-truss highway bridge, 6,535 ft long, having main span of cantilever type, symmetrically disposed, with channel opening of 871 ft center-to-center of main piers, and anchor arms of 326 ft $7^{1}/_{2}$ in, now in course of construction.

Steel Truss, Strengthening. New Trusses Reinforce Old Ones in Santa Fé Bridge. *Ry. Age,* vol. 104, no. 7, Feb. 12, 1938, pp. 299–301. Article tells how this road built new truss outside each old one in order to strengthen 3-span, single-track, deck-truss bridge across Brazos River near Granbury, Tex.

Suspension, Golden Gate. Golden Gate Bridge, J. B. Strauss. San Francisco, Calif., Golden Gate Bridge & Highway District, Jan. 1938, 146 pp., figs., diagrs., tables, maps. Final report of chief engineer on building of Golden Gate Bridge, covering history of project from its inception to its completion and including description of technical and other phases of work; planning and construction; tower erection; cable construction; construction of approaches; materials; fabrication of tower legs and stiffening trusses; shop painting.

Viaducts, Design. Reviewing Design and Bids for Concrete Pile Bridge, L. C. Hollister. *Western Construction News,* vol. 12, no. 12, Dec. 1937, pp. 476–478. Design studies for 4,000-ft viaduct being built by California Division of Highways between Marysville and Colusa; unit costs; bid analysis.

BUILDINGS

Air Conditioning Hospitals. Cooled Operating Rooms Prove Boon to Doctors, L. R. Flook. *Heating, Piping & Air Conditioning,* vol. 10, no. 3, Mar. 1938, pp. 182–184. Because necessary refrigeration capacity was already available, it was possible to convert existing ventilating system to complete cooling for three operating rooms and student amphitheater at Billings Hospital at very low cost; feature is special diffusing head for supplying and exhausting air.

Concrete. Construction of San Jacinto Memorial, C. A. Bullen. *Am. Concrete Inst.—J.,* vol. 1, no. 4, Mar.-Apr. 1938, pp. 421–432. Design and construction of reinforced concrete tower in San Jacinto battlefield, Texas, tapering from 48 ft square at base to 19 ft square at top, 570 ft above ground; safeguards to insure continuous placing; stone facing serving as outside form; towers and scaffolds.

Design. Continuity in Concrete Building Frames. 2d ed. Chicago, Ill., Portland Cement Assn., 1937, 68 pp., figs., diagrs., tables. Time-saving procedure for application of principles to office design practice; application of fixed-end moments; determination of moments and axial loads in columns; shears and positive moments; accuracy of frame analysis; eccentric wind pressure, vertical load, and wind pressure combined. Bibliography.

France. Les nouveaux batiments des Instituts de la Faculte des Sciences Appliquées, ancienne Ecole des mines de Liége. *Gênie Civil,* vol. 112, no. 2901, Mar. 19, 1938, pp. 241–246. Description of new buildings of departments of Faculty of Applied Sciences of former Liege School of Mines, France; equipment of chemical and materials testing laboratories; electric power plants; heating and ventilating installations.

Heat Insulation. Preventing Condensation in Insulated Structures. *Arch. Rec.* (combined with *Am. Architect & Architecture*), vol. 83, no. 3 Mar. 1938, pp. 118–119. Methods of preventing condensation in insulated structures based on research at U. S. Forest Products Laboratory and Engineering Experiment Station, University of Minnesota; methods of correcting chronic dampness conditions in existing work; venting of roofs above insulation protected by vapor barrier.

Prefabricated. Prefabrication Speeds Wall Erection. *Eng. News-Rec.,* vol. 120, no. 12, Mar. 24, 1938, pp. 429–430. Prefabrication of walls for timber buildings of Golden Gate International Exposition at San Francisco by laying out and assembling (on ground) large panels which then were lifted bodily to place; panel arrangement on end wall.

Soundproofing. Comparative Study of Sound Insulating Values of Steel Framed and Reinforced Concrete Buildings, C. W. Glover. *Structural Engr.,* vol. 16, no. 4, Apr. 1938, pp. 126–141. Review of principles of sound insulation as established by test; air transmission; sound insulating elements; complex partitions; floors; structure-borne sound; sound insulation in steel-framed building; sound insulation in reinforced concrete buildings; cost of insulation. Bibliography. Before Instn. Structural Engrs.

Steam Heating, Office Buildings. 22% Less Steam Heats Office Building, W. S. Downs. *Heating, Piping & Air Conditioning,* vol. 10, no. 3, Mar. 1938, pp. 177–180. Story of how steam consumption rate for one building has been reduced; difficulties met and how they were solved.

Ventilation, Exhibition Buildings. 2,000 Tons of Air per Hour for Ventilation. *Heating & Vent.,* vol. 35, no. 3, Mar. 1938, pp. 49–50. Description of air conditioning installation in London's new Earls Court Exhibition Center; heat is generated by central electric hot water plant and is distributed both by radiators and forced warm air.

CITY AND REGIONAL PLANNING

Industrial Economics. New Horizons in Planning. *Proceedings of National Planning Conference,* June 1–3, 1937. Chicago, American Society of Planning Officials, 1937. 178 pp., $2. Proceedings of Conference, in which four national planning organizations participated, containing collection of papers covering various phases of city, metropolitan, county, state, regional, and national planning. Eng. Soc. Lib. N.Y.

Zoning. Necessite d'un zoning dans Paris, E. De Groer. *Travaux,* vol. 22, no. 63, Mar. 1938, pp. 144–147. General discussion of necessity of zoning in Paris, France.

CONCRETE

Concreting Mine Shafts. Cyprus Mines Concrete 520-ft Circular Shaft Without Interruption to Mucking, F. K. McIntosh. *Eng. & Min. J.,* vol. 139, no. 3, Mar. 1938, pp. 36–37. Vertical and horizontal section dimensional data and description of concreting job on circular shaft with inside diameter of 14 ft 9 in.; has 2 hoisting compartments, ladderway, and pipe compartment; details of steel platform, concrete ring support, and lip forms.

Construction of Forms. Construction Design Chart—XXV—Deflection in Concrete Forms, J. R. Griffith. *Western Construction News,* vol. 13, no. 1, Jan. 1938, p. 40. Alinement chart for figuring allowable span for deflection of form sheathing; numerical examples.

Cracking. Cracking in Mass Concrete, R. F. Blanks, H. S. Meissner, and C. Rawhouser. *Am. Concrete Inst.—J.,* vol. 9, no. 4, Mar.-Apr. 1938, pp. 477–495. Some causes of cracking in mass concrete; experiences in crack control at Owyhee Dam, Boulder Dam, Morris Dam, Bartlett Dam, Norris Dam, etc.; concrete temperatures in dams; comparison of calculated temperature rises and observed values; temperatures in slab on concrete face of Arrowrock dam; equipment for laboratory tests.

Design. Reinforced Concrete Design Practice, A. Smith. *Am. Concrete Inst.—J.,* vol. 9, no. 4, Mar.-Apr. 1938, pp. 465–472. Discussion of Chicago engineer's practice in figuring thickness of base slabs of spread footings; footing caps; length of column dowels; offsets in vertical steel of columns, and clearance of rods above; inclined stirrups; shrinkage.

Disintegration. Resistance of Cements to Attack by Sea Water and by Alkali Soils, T. E. Stanton, Jr., and L. C. Meder. *Am. Concrete Inst.—J.,* vol. 9, no. 4, Mar.-Apr. 1938, pp. 433–464. Investigation of premature disintegration of concrete in pavements and structures in California during last 20 years; results of sulfate durability tests; chemical reactions of disintegration; comparative performance of modified sulfate resistant cements; relation between tricalcium aluminate content and loss in weight. Bibliography.

Forms. Use of Tubular Steel in Centering, A. E. Wynn. *Concrete & Constr. Eng.,* vol. 33, no. 4, Apr. 1938, pp. 219–228. Advantages and disadvantages of use of tubular steel for supporting centering of concrete arches and forms of other concrete members; design of timber forms when used in conjunction with tubular supports; safe loads; method of adjusting forms to exact heights; examples.

Mines. Placing of Concrete by Pump, P. G. Cowin. *Min. Congress J.,* vol. 23, no. 10, Oct. 1937, pp. 54–55. Description of concreting work done on PWA tunnel project for city of Little Rock, Ark.; equipment and practice considered as being applicable in placing of concrete under ground in inaccessible and restricted places, such as encountered in mines.

Roads and Streets. Twin Mixers Speed Paving. *Eng. News-Rec.,* vol. 120, no. 13, Mar. 31, 1938, pp. 463–465. Construction of concrete roads south of Gary, Ind., in which two pavers,

13 *Hard-working Years* and still no maintenance needed for this CONCRETE FLOOR

For 13 years this concrete floor has seen hard service in Continental Can Company's St. Louis plant—and it is still in excellent condition. Note that heavy bundles of steel sheets are moved on *steel-tired* trucks.

For your factory, industrial plant, garage or warehouse—store, office, or building for whatever purpose—it will pay you to specify a *concrete floor finish.* A properly finished concrete floor—

❶ Resists heavy abrasive traffic.

❷ Stays even; good drainage and easy trucking permanently assured.

❸ Promotes cleanliness—water-resistant, not harmed by water; no open joints to collect dirt; can be hosed or swept *clean.*

❹ Provides sure footing, sure traction; concrete retains its fine gritty texture wet or dry; special non-slip finish easily obtained.

❺ Is *firesafe.*

❻ Saves money in low first cost, low maintenance, freedom from repairs, more efficient haulage.

Let us send *"Concrete Floor Finishes"* showing how to build a durable, good-looking floor for your purpose.

PORTLAND CEMENT ASSOCIATION

Dept. A6-13, 33 West Grand Avenue, Chicago, Illinois

A National Organization to Improve and Extend the Uses of Concrete working boom to boom on 11-ft shoulders on opposite sides of two-lane slab, paved 1,500 to 1,800 ft daily.

Temperature Effect. Temperatures and Stresses in Mass Concrete, R. W. Carlson. *Am. Concrete Inst.—J.*, vol. 9, no. 4, Mar.-Apr. 1938, pp. 497–515. Review of data on temperature changes and resulting stresses in mass concrete; effect of type and quantity of cement, thickness of lift, pre-cooling of concrete, and high casting temperature; temperature variations near boundaries; horizontal and vertical stresses due to temperature changes.

Vibrating. Joint Sub-Committee on Vibrated Concrete. *Structural Engr.*, vol. 16, no. 4, Apr. 1938, pp. 142–150. Second interim report of joint sub-committee of Institution of Civil Engineers and Institution of Structural Engineers; further tests on concrete compacted on vibrating table; effect of cement and water-content, grading of aggregate time of vibration, acceleration, and revibrating on strength; shrinkage of vibrated concrete, etc.

DAMS

Concrete Arch, Wyoming. Seminoe Dam Construction Advances with River Diversion Completed. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 407–409. Progress report on construction of Seminoe concrete arch dam, 260-ft maximum height, 520-ft crest length.

Concrete, Construction. Placing of Concrete in Two Large Dams. *Reclamation Era*, vol. 28, no. 2, Feb. 1938, p. 36. Table giving records made in placing concrete at Boulder Canyon and Grand Coulee dams, with daily, monthly, and annual maximum quantities; progress of concrete placement for 12 canyon type dams in United States.

Failure. Why Marshall Dam Failed. *Eng. News-Rec.*, vol. 120, no. 12, Mar. 24, 1938, pp. 431–432. Report on borings and soil analyses made by board of engineers investigating cause of failure of Marshall Creek Dam in Kansas, indicating underlying strata composed largely of clays and silts capable of plastic flow; stability analysis of dam based on method developed by Swedish Geotechnical Commission.

Foundations. Alcova Dam Construction Work Featured by Extensive Grout Program. *Western Construction News*, vol. 12, no. 9, Sept. 1937, pp. 342–346. General features of Alcova earth dam in Wyoming; 256 ft maximum height; preparation of foundation requiring drilling of 13 miles of grout holes and pumping of 220,000 cu ft of grout to seal off springs of water; equipment used; unit costs bid.

Foundations. Underwater Exploration with Calyx Drills, H. R. Johnston. *Eng. News-Rec.*, vol. 120, no. 12, Mar. 24, 1938, pp. 436–438. Testing of site of Watts Bar Dam on Tennessee River by large bore holes sunk in midstream through sealed cylinder cofferdams; details of telescoping casings and cofferdam water seal that permitted calyx drilling in dry.

Montana. Building 200-ft Dam to Develop Power at Flathead Lake in Montana. *Western Construction News*, vol. 12, no. 11, Nov. 1937, pp. 424–427. Design and construction of concrete arch dam, 200-ft high, over 350 ft long, on Flathead River, near Polson, Mont., to control 10-ft range in lake level to provide 1,100,000 acre-ft of storage; construction features include unusual diversion program; effective use of site for gravity handling of materials and unique "safety pinning" of abutment rocks.

Multiple Arch, Madagascar. Le barrage-reservoir de Mantasoa, Crouzet. *Annales des Ponts et Chaussées*, vol. 107, no. 12, Dec. 1937, pp. 765–808. Design and construction of multiple-arch reinforced concrete dam at Mantasoa, near Tananarivo, Madagascar, having maximum height of about 19 m and length of 166 m; irrigation developments in Madagascar.

Spillways. Increasing Spillway Capacities at Four Large Dams on Salt River. *Western Construction News*, vol. 12, no. 11, Nov. 1937, pp. 453–456. Enlarging spillways at Horse Mesa, Mormon Flat, Stewart Mountain, and Roosevelt dams on Salt River in central Arizona.

Spillways, Model Testing. Keystone Dam Spillway Model, D. A. Buzzell. *Eng. News-Rec.*, vol. 120, no. 15, Apr. 14, 1938, p. 542. Description of 1/32 model (costing $1,000) of "morning-glory" spillway, with capacity of 50,000 cu ft per sec, now under construction for Keystone Dam in Nebraska; "morning glory" is 318-ft overflow weir turned into circle 101 ft in diameter at crest and warped down into 28 $^1/_2$-ft tube, which turns through 90 deg at ground line into 800-ft outlet tube passing under dam.

FLOOD CONTROL

Council Bluffs, Iowa. Putting a Creek in a Conduit, C. B. Burdick. *Eng. News-Rec.*, vol. 120, no. 13, Mar. 31, 1938, pp. 471–475. Flooding of section of Council Bluffs, Iowa, by overflow from Indian Creek, abated by doubling channel capacity and covering it for use as parking area; capacity determination; sidewall design; pile foundations; costs.

Mississippi River. Mississippi Control Works Tested by Flood, J. L. Schley. *Eng. News-Rec.*, vol. 120, no. 15, Apr. 14, 1938, pp. 533–537. Review of performance of Lower Mississippi flood control structures during unprecedented flood of 1937, emphasizing general success of system and pointing out some minor weaknesses; effect of 13 cutoffs along river; new flood estimates; effect of cutoffs on flood crests; flood characteristics.

HYDRAULIC ENGINEERING

Beaches, Erosion. Studies of Beach Erosion, E. I. Brown. *Eng. News-Rec.*, vol. 120, no. 8, Feb. 24, 1938, pp. 299–302. Report on studies of models of beach erosion with small wave tank of Beach Erosion Board; construction of large wave tank in Dalecarlia water reservation in Washington; compensation for tides; scale determination; apparatus developed for measuring wave characteristics in tank studies; plunger type of wave generator.

Flow of Water, Open Channel. Flow of Water in Short Channels, C. F. J. Lisle. *Instn. Civ. Engrs.—J.*, no. 2, Dec. 1937, pp. 287–308, supp. plate. Theoretical mathematical analysis leading to derivation of formula for determination of contour of water surface in channel which is not long enough to establish uniform velocity; specific energy; critical depth; entrance-conditions; change in slope of invert; stilling pools; experiments on models; tables of specific energy and friction losses in three types of channels.

Waves. Methodes d'étude des lames, J. Larras. *Travaux*, vol. 21, no. 58, Oct. 1937, pp. 446–450. Methods and equipment for determination of height, length, pressure, and energy of sea waves, for design of marine structures.

HYDROLOGY AND METEOROLOGY

Atlantic Ocean. L'établissement des cartes de l'atmosphère sur l'Atlantique Nord, etc., R. Bureau. *Génie Civil*, vol. 112, no. 2895, Feb. 5, 1938, pp. 124–127. Collection and broadcasting of information on weather conditions in North Atlantic and adjoining regions; preparation of weather maps; special meteorological equipment of steamship Carimare of Office National Meteorologique de France.

Lakes, Regulations. Régularisation du Lac Léman, J. Boissonnas. *Bul. Technique de la Suisse Romande*, vol. 63, no. 14, July 3, 1937, pp. 177–182. History of projects for control of level of Lake Geneva, Switzerland, since beginning of eighteenth century; long-range graphical records of fluctuations of lake level; outline of recently proposed plan of control.

Run-Off. Daymond Theory of Storm Water Run-Off Applied to Reservoired Catchment Areas, D. Lloyd. *Water & Water Eng.*, vol. 39, no. 483, Sept. 1937, pp. 497–498. Reference is made to paper by J. R. Daymond previously indexed from *Instn. Civ. Engrs.—J.*, June 1937; present note is to indicate how Daymond theory may be extended to include condition occurring on catchment of moderate area which may be capable of being reservoired.

Tides, Bench Marks. Tidal Bench Marks. *U. S. Dept. Commerce—Coast & Geodetic Survey*, Feb. 1938, 81 pp. Descriptions and elevations of tidal bench marks established in State of New Jersey, by U. S. Coast and Geodetic Survey and other federal, state, and municipal organizations.

INLAND WATERWAYS

Siphon Spillways. Flood Control for London Reservoir. *Civ. Eng.* (London), vol. 32, no. 374, Aug. 1937, pp. 298–299. Description of battery of five concrete siphon spillways, designed to discharge 600 cu ft per sec each, from Brent reservoir in Urban Districts of Hendon, Willesden, and Kingsbury, utilized for supply of water to canal.

IRRIGATION

Australia. Water for Irrigation. *Commonwealth Engr.*, vol. 25, no. 5, Dec. 1, 1937, pp. 161–167. Proposed extension of Goulburn system which is largest irrigation project in Victoria, including enlargement of Waranga Western Main Channel to meet peak demands when ultimate development of existing storages has been reached; estimated cost £129,030.

California. Central Valley Project of California, W. R. Young. *Reclamation Era*, vol. 28, no. 2, Feb. 1938, pp. 22–25. Outline of general plan and principal structures of Central Valley Irrigation Project of California.

Canals, Construction. Excavation and Structures Well Advanced Along 40 Miles of Alcova Main Canal. *Western Construction News*, vol. 12, no. 9, Sept. 1937, pp. 346–349. Excavation and structures along first 40-mile section of main canal for Kendrick Project (previously known as Casper-Alcova Project), Wyoming; capacity of canal is 1,200 cu ft per sec; details of double-barreled culverts; siphon construction; machine records; operation of draglines; cost figures; equipment.

Silt Control. Consideration of Silt in Design and Maintenance of Open Earthen Channels, R. K. Khanna. *Indian Eng.*, vol. 102, no. 5, Nov. 1937, pp. 169–170. Review of silt problem and irrigation canals of India; with special reference to effectiveness of devices for excluding silt from canal.

United States. Bureau of Reclamation Program for Construction in 1938. *Western Construction News*, vol. 13, no. 1, Jan. 1938, pp. 13–16. Outline of proposed irrigation and reclamation work on 56 projects in Western United States, during 1938, with appropriations totaling $80,403,000.

Water Supply, United States. Six-Year Plan Made for Water Control. *Eng. News-Rec.*, vol. 120, no. 11, Mar. 17, 1938, p. 388. Brief outline of 6-year program of investigation and construction for use and conservation of water resources of United States, recommended in report of National Resources Committee transmitted to Congress, including lists of federal projects with total cost of $891,091,000.

LAND RECLAMATION AND DRAINAGE

Drainage, Ontario. Agricultural Drainage in Southwestern Ontario, G. A. McCubbin. *Eng. J.*, vol. 21, no. 2, Feb. 1938, pp. 66–70. Description of larger drainage schemes in Southwestern Ontario; legal questions connected with such undertaking; study of stream flow and flood records indicating no appreciable increase in flood discharge subsequent to active period of drainage construction in area. Before Eng. Inst., Canada.

Netherlands. Een onderzoek naar de economie van ontwateringswerken, E. J. Bosch van Rosenthal. *Ingenieur*, vol. 53, nos. 11, 12, and 14, Mar. 18, 1938, pp. T.9–19; Mar. 25, pp. T. 21–30; and Apr. 15, pp. T.31–43. Study of costs of draining projects; analysis of costs for works carried out in Netherlands at various periods under different conditions.

Roads and Streets. Drainage in Highway Construction, A. Paradis. *Can. Engr.*, vol. 73, no. 12, Sept. 21, 1937, pp. 142, 144, 146, and 148. Review of drainage problems in road construction in Canada; drainage from farm lands; straightening streams; rules for surface drainage; construction of ditches; longitudinal slopes of ditches; subdrainage; gravity and capillarity; rules for subdrainage systems; practical application of rules; value of blind drains.

MATERIALS TESTING

Strength of Materials. Strength of Materials. J. M. Lessells. *Mech. Eng.*, vol. 60, no. 5. May 1938, pp. 416–417. Mechanical engineers, as a rule, have very little to do with concrete or wood in their design work, and therefore do not realize potential uses of these materials; author, who is associate professor at Massachusetts Institute of Technology, explains reason for setting up special course to be given at Institute; comparison of available knowledge on strength of steel, concrete, and wood.

PORTS AND MARITIME STRUCTURES

Breakwaters, Model Testing. Contribution à l'étude expérimental des digues maritimes en enrochements, A. Stucky and D. Bonnard. *Bul. Technique de la Suisse Romande*, vol. 63, no. 18, Aug. 28, 1937, pp. 232–237. Report from Hydraulic Laboratory of School of Engineering of University of Lausanne, Switzerland, on tests of models of proposed rubble mound breakwaters, 1,000 m long, for Leixoes, Portugal; stability of breakwaters. (To be continued.)

Current Projects. Harbours and Waterways in 1937. *Engineer*, vol. 165, nos. 4279 and 4280, Jan. 14, 1938, pp. 40–41, and Jan. 21, pp. 70–72. Works carried out in United Kingdom, Europe, Africa, the Orient, and America, on ports and waterways.

Docks, Dover, England. Dover Train-Ferry Dock, G. Ellson. *Inst. Civ. Engrs.—J.*, no. 2, Dec. 1937, pp. 223–246, (discussion) 247–260, supp. plates. Design and construction of recently completed British terminal of English Channel train ferry, including block-work walls; pump chamber, walls and floor of dock, pump-house, dock sill and jambs, dock gates, machinery pit shafts, link-span bridge, approach jetty, pumps, motor car ramp, and drawbridge; new Clarence quay.

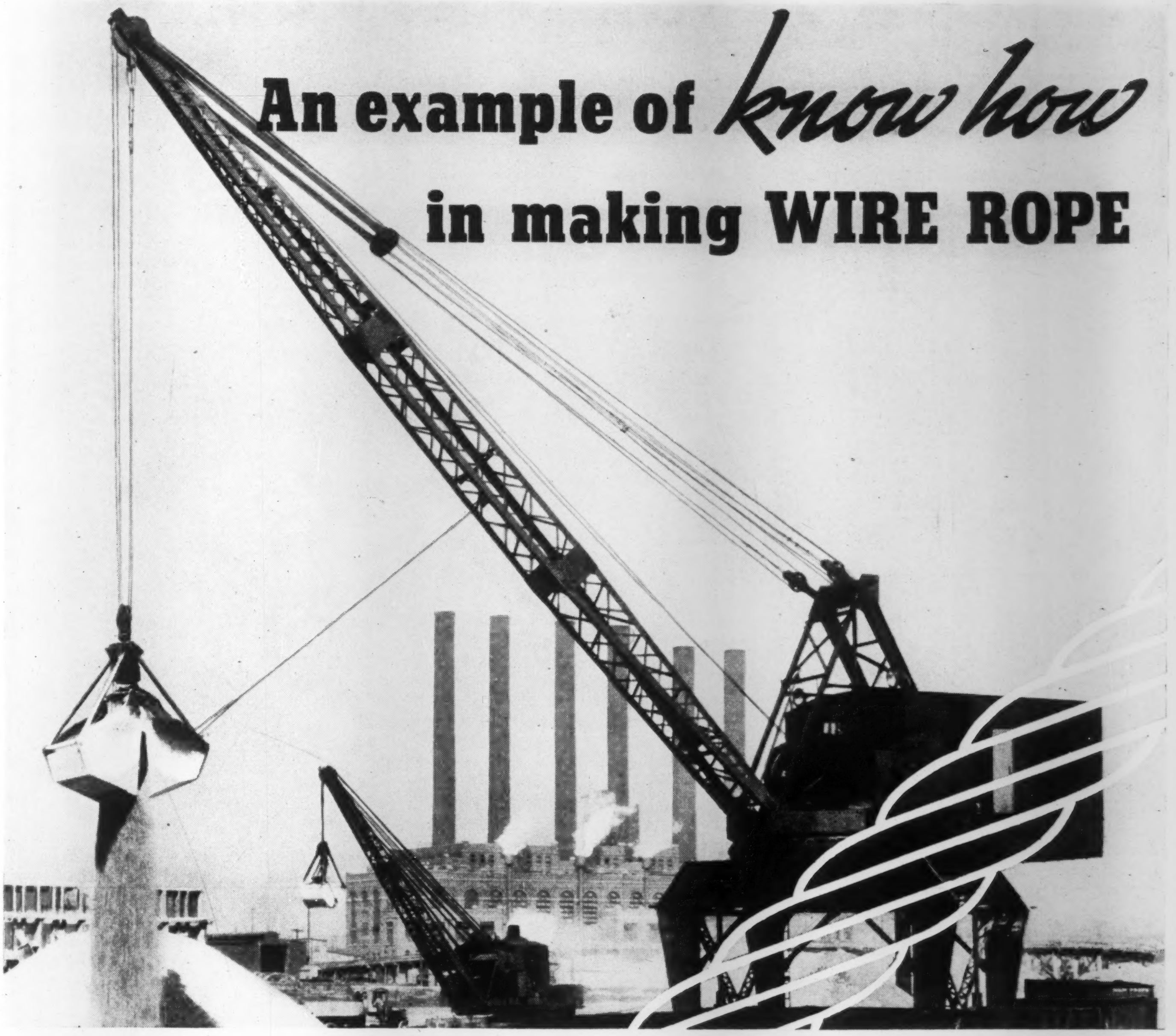
Docks, London. New Monolith Quay for London. *Civ. Engr.* (London), vol. 32, no. 374, Aug. 1937, pp. 290–292. Description of recent improvements at Royal Victoria dock, London, including sinking of 44 monoliths 24 ft 6 in. square.

Docks, Toronto. New Coal Dock for Toronto Harbour, R. F. Legget. *Civ. Eng.* (London), vol. 32, no. 374, Aug. 1937, pp. 284–287. Description of new Toronto coal dock, largely built of steel sheet piling, costing about $700,000.

Jetties. Jetty Head to Be Protected by Massive Concrete Block. *Western Construction News*, vol. 12, no. 9, Sept. 1937, pp. 350–351. Design of jetties at mouth of Umpqua River, Oregon, involving head protection consisting of series of smaller concrete wing blocks attached by chains to main unit.

Jetties, Sheboygan, Wis. Relief Project Provides Work and Saves City's Shores, A. L. Boley. *Am. City*, vol. 53, no. 3, Mar. 1938, pp. 61–62. Description of several jetties, up to 228 ft in length, on Lake Michigan Shore at Sheboygan

(*Continued on page 22*)



CLAMSHELL ROPE with resilience to it

Shock resistance is a characteristic of Bethlehem Clamshell Rope. A result, not of 6 x 25 construction, Purple Strand quality, or even preforming, but of "know how" in building the rope. For Bethlehem Clamshell Rope is built with resilience to it. Definite, measurable differences, as compared to dragline, for example, enable it to stand up under shocks and jerks that shorten the life of ordinary rope for this application.

For one thing, the lay of Bethlehem Clamshell Rope is slightly shorter than for most other ropes—allowing an elastic "give" to the line when suddenly stressed. For another, the core is slightly over-size, giving additional support to the steel strands, and cushioning the resilience of the rope. Special internal lubrication of the core as well as of wires and strands retards damage from running fast over small sheaves. These are built-in special features in this rope—results of knowing how to build a line *for the job on which it will be used.*

Bethlehem (formerly Williamsport) Wire Rope has a background of half a century of experience in meeting the wire-rope requirements of industry, and the metallurgical knowledge of an organization making practically all kinds of steel for all industries. You can depend on it.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Centrifugal Pumps

The Gardner-Denver Company, Quincy, Ill., announces their Types "J" and "K" Non-Clogging Centrifugal Pumps, which are adapted for handling industrial wastes, process fluids, raw unscreened sewage, and liquids in which quantities of solids are held in suspension. These pumps are built of alloyed cast iron, for both horizontal and vertical dry pit installations.

GARDNER
DENVER
MADE IN U.S.A.

The side suction enclosed-type impeller has two streamlined blades, rounded to prevent catching stringy or fibrous material, and proportioned to permit the passage of the size solids, indicated for each size pump, without clogging. The casing of the Type "J" and "K" pumps is symmetrical so that it can be used for both right and left-hand pumps with proper impeller. The discharge nozzle can be placed in any one of eight positions. The stuffing box is a separate casting bolted directly to the casing and is extra deep to receive a minimum of six rings of packing. Heavy-duty double-row grease-lubricated ball bearings contained in dust and splash proof housing insure quite operation and long life. Disc or flat type renewable double wearing rings are provided on the impeller and front head. This type of wearing ring throws abrasive materials from between the wearing surfaces by centrifugal force.

The mechanical construction of the "J" and "K" pumps is identical except that the frame of the Type "J" pump has a foot cast integral with it and the Type "K" pump has the foot or base bolted on the suction side of the volute.

New Welding Electrodes

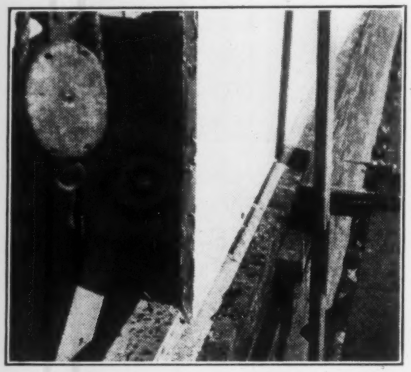
Three new arc welding electrodes, each protected by a heavy extruded coating, have been announced by General Electric Co., Schenectady, N.Y. These electrodes are designated as Type W-20E, Type W-22E, and Type W-23E, respectively. They are designed for general-purpose, single- or multiple-pass arc welding of mild steel, and are reported to produce welds of qualities in excess of those required to meet paragraphs U-68 and U-69 of the A.S.M.E. Boiler Code.

Industrial Curtain Wall

Johns-Manville announces a new type of insulated industrial curtain wall for steel frame factory buildings. The method of wall assembly, which is suitable for practically all types of industrial buildings—such as warehouses, factories, light manufacturing buildings, etc.—was developed by J-M and is covered by patents.

J-M Industrial Curtain Walls consist of an application of Encased Insulating Board (1 in. of Insulating Board with a $^1/_8$ in. veneer of Asbestos Flexboard or Flat Transite) over which is applied a wall of Corrugated Transite. Between the windows, the wall is constructed from Encased Insulating Board to which is cememted a $^3/_8$ in. sheet of Flat Transite to form the exterior surface. The completed structure provides an interesting, modern effect.

Johns-Manville states that the use of Transite and Flexboard surfaces—both of asbestos-cement composition—provides fireproof walls which not only are incombustible but also are capable of withstanding high temperature without melting, cracking, or buckling—a quality which assures maximum protection against the spreading of flames to or from adjoining buildings. Laboratory tests show that a 1 in. thickness of Insulating Board encased in this manner affords the same insulating value as a 14 in. thickness of common brick, and yet weighs approximately one-twentieth as much.

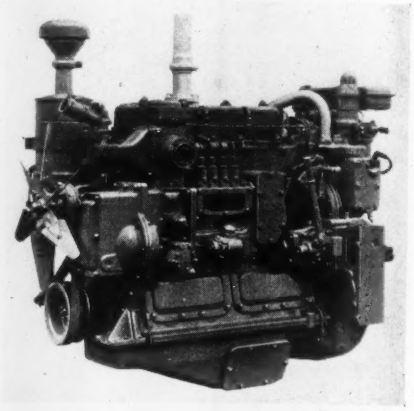


Units of Encased Insulating Board are held against the steel framework of a building by cadmium plated bolts, and gray caulking compound is applied to the edge of each sheet. Since the thermal expansion of Transite is approximately the same as that of steel, no expansion joints are necessary. No special tools are required for the erection of Johns-Manville Industrial Curtain Walls, as the material may be easily sawed, drilled and fitted into place with ordinary carpenter's tools. In the event alterations are necessary, the curtain wall units may be relocated with almost complete salvage of materials and with great economy of time. The walls are light gray in color and require no painting. However, they may readily be painted after receiving a priming coat of boiled linseed oil.

Smaller "Cat" Diesel

An industrial engine for the smaller power uses is the Diesel D3400, announced by Caterpillar Tractor Co., Peoria, Ill.

The new engine is a four-cylinder model with 3$^3/_4$ in. bore and 5 in. stroke. It develops 33 hp at 1525 governed rpm. The D3400 engine is generally similar to other "Caterpillar" Diesels, featuring the four stroke cycle, valve in head, water cooled design, with solid fuel injection into precombustion chambers.



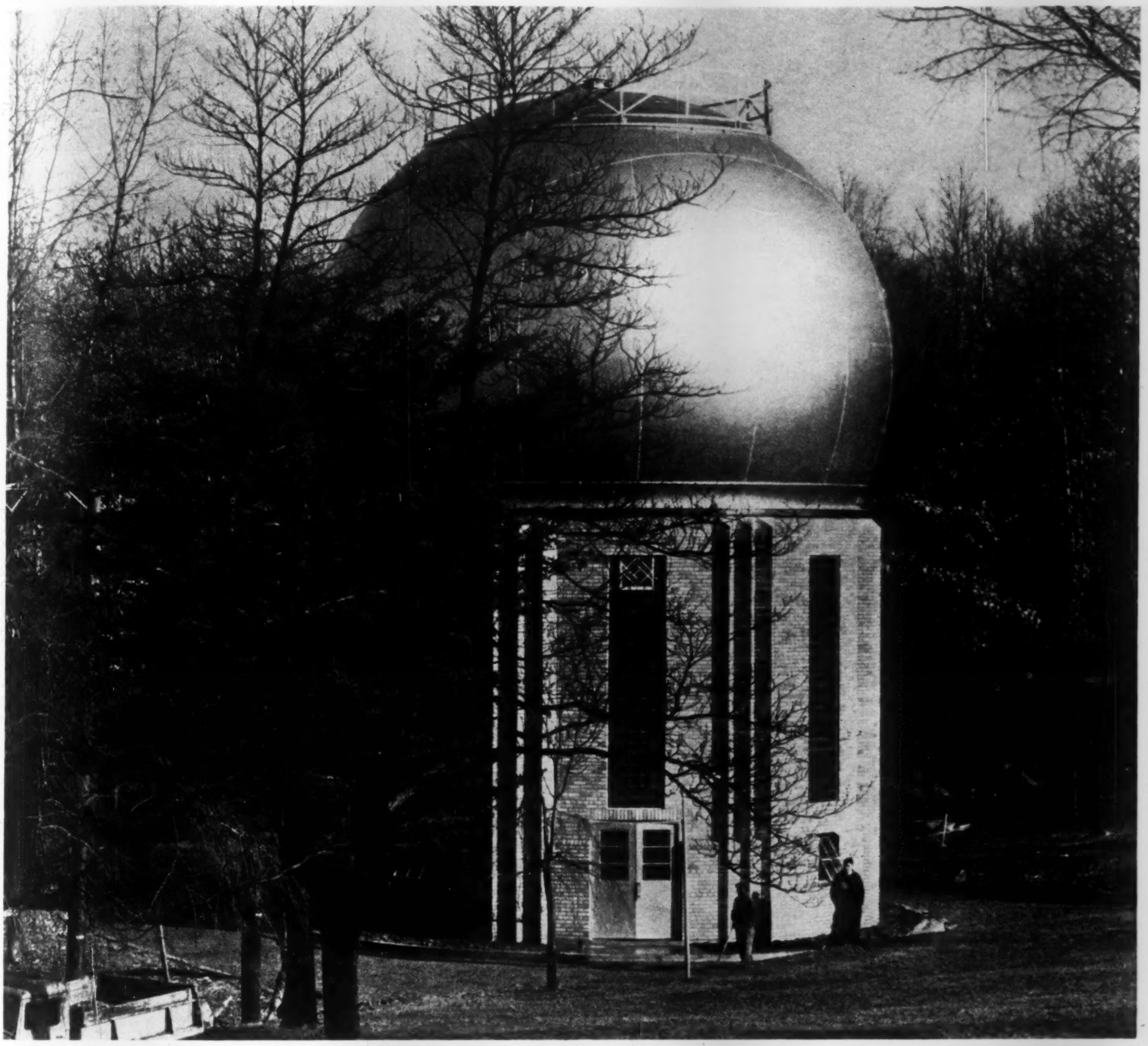
In construction work, the engine is the proper size for powering smaller portable equipment, $^3/_8$ yd draglines and shovels, and smaller industrial locomotives. Connected to a 15 kw generator, it will provide smooth, even power. It is also well suited for irrigation work, and other pumping jobs within its capacity.

Simple in design, the D3400 engine contains only three operating adjustments—the valves, water pump, and fan. Fuel injection pumps and valves are factory set, and require no adjustment on the job. Seals and air cleaners insure ample protection. For quick, easy starting, a 10 hp gasoline engine is used. A hot water manifold, on the front of the fuel filter housing, keeps the fuel oil at the proper temperature, regardless of climatic conditions. The engine also features a twin radiator, which has been developed by "Caterpillar" engineers. One is for cooling the water, and the other for cooling the lubricating oil, thus assuring longer life for the main engine bearings.

New Respirator

Development of a new type of respirator which will prevent silicosis, if worn faithfully, has just been announced from the laboratories of American Optical Company.

New features as reported are: Compactness, light weight, unobstructed vision, facial adjustment unnecessary, improved valves which ease inhalation and exhalation, easy to keep in efficient working order, and an effective filter area of 42 sq in. This unit is approved by the U. S. Bureau of Mines for Type-A dusts.



.... it turned out to be a PEAR

Some months ago scientific men asked us to build a pressure vessel to house apparatus used in smashing atoms. The purpose of the pressure vessel is to provide insulation for the tube, which is charged with 5,000,000 volts of electricity.

The tube is mounted vertically, with a corona cap at the top. The shell is built in the shape of a pear to provide the necessary clearance around the apparatus.

The above view shows one of these "atomic-physics observatories" at the Carnegie Institution of Washington. The small end of the pear, which points downward, has been housed in. The shell is $37^1/_2$ ft. in diameter at its largest point and 55 ft. high.

You may never be called upon to design an atomic-physics observatory, but you no doubt will have use sometime for pressure vessels in either ordinary or special shapes. When such time comes, we will appreciate the opportunity of submitting estimating figures on your requirements.

We have also built a pear-shaped vessel to house atom-smashing equipment at Pittsburgh, a vertical pressure tank of uniform diameter for the same purpose at Minneapolis and a cylindrical tank for an installation at Houston.

CHICAGO BRIDGE & IRON COMPANY

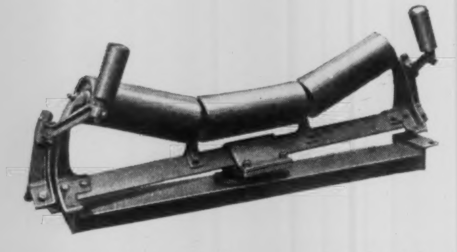
Chicago	2199 Old Colony Bldg.	Boston	1545 Consolidated Gas Bldg.	Tulsa	1647 Hunt Bldg.
Detroit	1541 LaFayette Bldg.	Philadelphia	1652-1700 Walnut Street	Birmingham	1596 N. 50th Street
Cleveland	2263 Rockefeller Bldg.	Dallas	1485 Liberty Bank Bldg.	San Francisco	1084 Rialto Bldg.
New York	3395—165 Broadway Bldg.	Houston	2919 Main Street	Los Angeles	1456 Wm. Fox Bldg.

B-581

PLANTS in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Self-Aligning Belt Idler

A new self-aligning idler for automatically training conveyor belts without damaging the belt is announced by The Jeffrey Manufacturing Co., Columbus, Ohio. It consists of a standard anti-friction idler pivotally mounted on a supporting cross member, with guide rolls at each end. These guide rolls are mounted on pivoted arms that extend at right angles to the idler in the direction from which the belt approaches. The arms are held in place by an easily removed locking pin. By swinging the arms through 180 deg and putting the lock-pin in place on the opposite side, the guides are made ready to train the belt when traveling in the reverse direction. There is no pressure between the guide rolls and belt to damage the edge of the belt. The guide roll moves outwardly the instant the belt touches it, and so swivels the idler sufficiently to cause the belt to return to normal position.



Electric Gate Operator

A new electric, motor-driven gate operator announced by the Kinnear Manufacturing Company, Columbus, Ohio, permits the operation of sliding types of gates from remote control stations. The momentary-contact control switch is provided with "Open," "Close," and "Stop" buttons to operate the gate at an approximate speed of 2 ft per sec. The gate is attached by means of a spring-cushioned operating arm to an endless roller chain driven by the electric operator. The motor is provided with a slip clutch which prevents the power unit from damaging the equipment in case the unit is stopped by some obstacle in the opening. The operator and travelling roller link chain is encased against weather in a metal housing.

Controlled Concrete

The service and equipment of the Scientific Concrete Service Corp., Washington, D.C., is being offered to central mixing plants for the "precision control of concrete manufacture." The equipment used is the batching and weighing machinery developed by the Toledo Scale Co., on the basis of the inventions of Col. Sidney F. Mashbir. By automatic determination of the total moisture contained in the sand and gravel, and by accurately weighing all ingredients, this equipment is claimed to assure the production of concrete of predetermined uniform quality and strength.

It is reported that "scientific concrete" will be available in Detroit, Michigan.

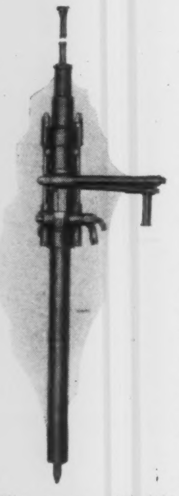
Submersible Pump

After eight years of successful performance under a wide range of operating conditions, the Submersible deepwell turbine pump has been placed on the market by Byron Jackson Company.

This deepwell turbine pump has its motor below the turbine bowls. The propelling shaft is very short and the unusually long, small diameter motor operates submerged at all times in the well water. However, the liquid pumped does not come in contact with the electrical parts or motor bearings, as these are enclosed in an oil-filled case with a mercury seal where the shaft passes through at the top. The turbine and the submersible motor form a compact unit that is attached to and supported by the discharge pipe. A submarine armored cable and a small copper oil tube, form the only connection (aside from the discharge pipe) between the pumping unit and the surface of the ground. The Submersible operates equally well and without frequent attention, in deep or shallow wells, crooked or straight wells, sumps or natural bodies of water.

Hand Rotated Stopehamer

Ingersoll-Rand has recently introduced a new hand rotated Stopehamer known as the "SA-90." This machine embodies several new features of design. The piston is solid except for the water tube hole and combines the advantage of long wearing surfaces with rugged resistance to breakage. The throttle valve consists of two circular plates held together by air pressure, which yields the ease of operation of the straight throttle and materially increases the life of this part. The fronthead is of the shrouded type overlapping the cylinder and increasing the rigidity of the drill at this point. The new, double opening, direct flow main valve is claimed to be responsible for the low air consumption and high drilling speed of this stoper.



Bulletin 2409 may be obtained from Ingersoll-Rand, 11 Broadway, New York, N.Y.

Simple Wind Indicator

A new wind indicator of a very simple type has been announced by Julien P. Friez & Sons, Inc., Baltimore, Md. The instrument is accurate over its entire range and requires no correction factor. The 8 in. transmitter weighing one lb requires only annual painting and oiling for satisfactory operation under all conditions. The complete assemblage consists of transmitter and indicator.

Folders Announced

Belt Idlers—Complete details of a new line of Timken bearing equipped idlers are given in a 24-page bulletin. C.O. Bartlett & Snow Co., Cleveland, O.

Buckets—A catalog comprised of individual bulletins describes the Williams Power-Arm Type, Multiple Rope, Clean-Up, Dredging, Hook-On, Dragline and specially built buckets of The Wellman Engineering Company, Cleveland, Ohio.

Compressors—New models, new designs and new features of their "Fordair" Compressor are embodied in a new 12-page bulletin, No. 3815-CG, released by Schramm, Inc., West Chester, Pa.

Diesel Engines—Maximum and rated performance curves of the seven current sizes of "Caterpillar" Diesel Engines; a brief résumé of the outstanding characteristics; mechanical features of the engines; and illustrations of models and explanatory mechanical cutaways; are included in a three-color booklet, Form 4253. Caterpillar Tractor Co., Peoria, Ill.

Electric Motors—"Electric Drive Selector and Hints on Maintenance" is the title of a 12-page publication about motors. It gives types of motors, applications, and includes concrete examples of installations. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Highway Lighting—The need for lighting, as well as recommendations to meet this need, are covered in a new eight-page bulletin GEA-1097B, published by General Electric Co., Schenectady, N.Y.

Nozzles—The first printed material on the Kennison Open Flow Nozzle, for the metering of raw sewage and trade wastes is bulletin 289 of Builders Iron Foundry, Providence, R.I.

Roofing Specifications—A new edition of the Koppers standard roofing specifications book contains complete specifications for all types of coaltar pitch and tarred felt roofs. Diagrams illustrate each set of specifications. A large portion of the book is devoted to illustrated descriptions of various methods of waterproofing and dampproofing. Koppers Co., Pittsburgh, Pa.

Shovels—The Gopher $^{1}/_{2}$ yd shovel, Model 350, is completely catalogued in a new 24-page booklet, GS-3, American Hoist & Derrick Co., St. Paul, Minn.

Steel—Copper Alloy—A new, 16-page, pocket-size booklet on U.S.S. Copper Steel, entitled "A Little Copper in Steel Gives a Lot of Protection," gives the results of the latest American Society for Testing Materials' experiment on the atmospheric corrosion resistance of various grades of steel and iron; and describes applications of U.S.S. Copper Steel in various industries. United States Steel Corporation Subsidiaries, Box 176, 434 Fifth Avenue, Pittsburgh, Penna.

Treated Timber—An illustrated booklet, "Pressure Treated Timber—from the Tree to the Job," discusses pressure processes, preparation of timber before treatment, its economy and uses in industrial plants, in coal mines, for wharves, bridges and other underwater construction, as well as railroad and residential construction. Numerous photographs illustrate a wide variety of construction projects employing treated timbers. The Wood Preserving Corporation, Pittsburgh, Pa.

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With the introduction of the new Atlas Manasite Blasting Caps and Electric Blasting Caps, safety precautions in blasting operations become more effective than ever.

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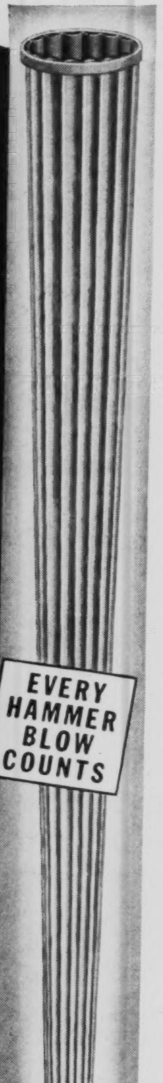

(*Continued from page 16*)

Wis., constructed of 3-ton precast concrete units laid in tiers forming permeable checkerwork; making blocks; erection of jetty.

Miscellaneous Data. Seehafenbau, F. W. O. Schulze. Berlin, Wilhelm Ernst & Sohn, 1937, vol. 2, no. 4, pp. 241–320, and no. 5, pp. 321–400, figs., diagrs. Data on design and construction of ship moorings, planning and operation of naval and commercial ports, also fishing harbors; port equipment and structures, including warehouses; mechanical equipment of modern ports, with special reference to cranes, transporters, etc.

ROADS AND STREETS

Alps. Die hoechste Passtrasse der Alpen, A. Kalter. *Verkehrstechnik*, vol. 19, no. 5, Mar. 5, 1938, (supp.) pp. 130–131. Design and construction of new paved highway, 29 km long, over Col de l'Iseran, in French Alps, which is highest mountain highway in Europe.

Asphalt. Laying 2,000 Tons of Asphalt a Day for Los Angeles Street Resurfacing, M. M. Meyer. *Western Construction News*, vol. 12, no. 12, Dec. 1937, pp. 473–475. Review of Los Angeles, Calif., program of street reconstruction during past six years; 25,000,000 sq ft reconditioned last year; types of surfacing and field operations; reconstruction of paved roadways; resurfacing oiled-gravel streets; asphalt mixing plants.

Bituminous. Bituminous Highway Developments on Projects in Pacific Northwest, A. H. Benedict. *Western Construction News*, vol. 12, no. 9, Sept. 1937, pp. 334–336. Outstanding and non-routine design and construction features of national forest and park highway work in states of Washington, Oregon, and Montana; soil investigation; bituminous construction; maintenance.

Bituminous. Paving Program at Spokane Is Featured by Low Cost, A. D. Butler. *Western Construction News*, vol. 12, no. 11, Nov. 1937, pp. 428–430. Construction practice of city of Spokane, Wash., in bituminous surfacing on 34 miles of streets laid at cost of 65 cents per sq yd; operations carried out by city forces; cost details of typical paving projects; mixing plant; paving operations.

Concrete. Joints in Concrete Roads. E. Probst. *Concrete & Constr. Eng.*, vol. 33, no. 3, Mar. 1938, pp. 142–144. Results of recent German tests bearing on design of joints for concrete pavements.

Concrete. Portland Cement Soil Concrete Used on First Western Highway Project. *Western Construction News*, vol. 12, no. 11, Nov. 1937, pp. 441–443. Description of experimental highway section, 3,840 ft long, built of cement soil mixtures by California region of U. S. Forest Service, with cooperation of Portland Cement Association; preparing soil; determining cement content; applying cement; compacting mixture; costs.

Construction. Extensive Equipment Fleet Used on Record Highway Grading Job. *Western Construction News*, vol. 12, no. 12, Dec. 1937, pp. 463–466. Methods and equipment used in construction of Altamont Pass highway, San Francisco, Calif., requiring 1,875,000 cu yd of excavation; contractor's organization; material handling methods; excavating rock in side-hill cut; progress; grade separation structures.

Design. Construction of Divided Highways in Ontario, R. M. Smith. *Can. Engr.*, vol. 73, no. 12, Sept. 21, 1937, pp. 76 and 79. Review of Ontario practice in construction of divided highways, taking into account local traffic problems; highways in Europe; 4-lane highways; railway crossing elimination; design of highway.

Design. Eleven-Foot Highway Lanes Adopted by California. *Western Construction News*, vol. 12, no. 11, Nov. 1937, p. 423. Adoption of 11-ft minimum width of traffic lane by California Division of Highways.

Highway Systems, United States. *Western Construction News*, vol. 13, no. 1, Jan. 1938, pp. 6–7. Proposed 1938 highway construction in Nevada, Montana, New Mexico, Wyoming, and Colorado.

Railroad Crossings, Elimination. Noteworthy Grade Separation Completed at Chicago. *Ry. Age*, vol. 104, no. 11, Mar. 12, 1938, pp. 442–445. Article describes 3-leg, steel-rib, rigid-frame structure at Cermak road, which embodies eye-bar ties across street beneath pavement.

Railroad Crossings, Signals and Signaling. Barriers on Boston & Maine. *Ry. Signaling*, vol. 31, no. 3, Mar. 1938, pp. 152–154. Retarding barriers, red-green traffic type signals, and crossing bell—all controlled automatically by track circuits—were installed at Newmarket, N.H., to replace gates; western barrier located 70 ft from nearest rail, while eastern barrier is 79 ft from rail; barriers each consist of two 10-ft sections, which extend entirely across 20-ft paved section of highway.

Snow Control. Snow Removal and Ice Treatment on Rural Highways, H. A. Radzikowski. *Pub. Roads*, vol. 19, no. 1, Mar. 1938, pp. 9–13. Design of modern highways so as to minimize amount of snow-removal work; snow-removal and ice-treatment data for winter of 1936–1937; spreading sand or cinders over ice; sand spreader developed and used by Oregon State Highway Department.

Stabilization. Stabilizing of Soils with Emulsified Asphalt, H. C. Flinn. *Can. Engr.*, vol. 73, no. 12, Sept. 21, 1937, pp. 136, 138, 140 and 142. Nature of clay bond; emulsified asphalt admixtures; description of process; properties of stabilized mixtures; qualities of emulsified asphalt stabilizer; thickness of stabilized mixtures; mixing by road graders; surfacing stabilized mixtures; present use of stabilized mixtures.

Traffic Surveys, Los Angeles, Calif. Traffic Survey Los Angeles Metropolitan Area 1937. Automobile Club of Southern Calif.—Eng. Dept. 1937, 50 pp., figs., diagrs., tables. Report covering following subjects: present and estimated future population; automobile parking; recommendations as to motorways, land service streets and highways, motor vehicle parking, financing, and administration; traffic checks; traffic counts; capacity and average daily use of public parking garages and parking lots.

United States. Trend of Modern Highways, T. H. McDonald. *Roads & Streets*, vol. 80, no. 8, Aug. 1937, pp. 40–42. Important causes of change in highway utilization and improvement; factors determining trend; scientific planning; soil stabilization, grade crossing elimination; German system of superhighways. Before Am. Assn. Civ. Engrs.

SEWERAGE AND SEWAGE DISPOSAL

Activated Sludge. Stabilization of Sewage Sludge Banks, W. Rudolfs. *Indus. & Eng. Chem.*, vol. 30, no. 3, Mar. 1938, pp. 337–340. Results of experiments undertaken at New Jersey Agricultural Experiment Station, New Brunswick, N.J., in which raw sewage and activated sludges were stored to determine rate and degree of stabilization in effort to determine degree and duration of effect of sludge banks on overlying water. Bibliography. Before Am. Chem. Soc.

Activated Sludge. Studies on Clarification Stage of Activated Sludge Process—V. R. S. Ingols. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 49–59. Studies on ammonia uptake by activated sludge in which attempt has been made to evaluate relative importance of physical or biological processes in initial removal of ammonia by sludge; base exchange studies; electrodialysis and NaCl washing; aeration experiments with ammonia and activated sludge; comparison of rate of ammonia uptake by activated sludge under varying treatment. Bibliography.

Chlorination. Aspects of Sewage Chlorination in 1937. L. H. Enslow and H. A. Faber. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 74–80. Review of recent American developments in connection with chlorination; indirect chlorination; oxygen demand reduction; sludge bulking; aero-chlorination for grease separation.

Digestion. Disposal of Sewage and Garbage—Related Municipal Functions, M. M. Cohn. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 81–90. Methods of combining sewage and garbage; central grinding stations; household grinding; grinding stations at sewage plants; sewage refuse disposal plants.

Disposal. Sewage Treatment: Modern Answer to Ancient Problem, M. M. Cohn. *Gen. Elec. Rev.*, vol. 41, no. 4, Apr. 1938, pp. 170–177. Character of sewage; processes for removal of solids; oxidation of dissolved organic matter; removal of bacteria; disposal of solids; purity of effluent.

Disposal Plants, Experimental. Experimental Work in Progress at West Side Sewage Treatment Works of Sanitary District of Chicago, T. L. Herrick. *Sewage Works J.*, vol. 10, no. 2, Mar. 1938, pp. 276–292. Description of experimental units including high-rate trickling filter, small-scale activated sludge unit, two-stage biofilter, chemical precipitation plant, activated sludge unit designed to operate under very low aeration periods; sponge aeration process and activated sludge; operating results.

Equipment. Maintenance and Lubrication of Sewage Clarifiers, G. D. Powell. *Am. City*, vol. 53, no. 1, Jan. 1938, pp. 80 and 83. Starting new clarifier; sludge pumping; causes and cures for common troubles; routine maintenance measures; lubrication of clarifiers.

Flow Diagrams. Flow Diagrams of Typical Treatment Plants. *Mun. Sanitation*, vol. 8, nos. 10, 11, and 12, Oct. 1937, pp. 532–534 and 537–538; Nov., p. 596; and Dec., p. 658. Symposium includes: Sewage Treatment Plant Minneapolis-St. Paul Sanitary District, G. J. Schroepfer; West Side and Southwest Side Sewage Treatment Works of Sanitary District of Chicago; Coney Island Chemical Treatment Plant, R. H. Gould; Detroit Sewage Treatment Plant, A. B. Morrill; Ilion, New York, Wastes Disposal Plant, H. W. Taylor; Los Angeles Sewage Disposal—Terminal Island Plant, J. F. Skinner and L. Aldrich.

Irrigation. Irrigation Water Reclaimed from Sewage, H. N. Jenks. *Mun. Sanitation*, vol. 8, no. 11, Nov. 1937, pp. 574–576. Application of bio-filtration process in two-stage, complete-treatment, water-reclamation plant at San Mateo, Calif., for providing irrigation supply for municipal needs; design and construction elements; scope of work; recirculation system; detention settling tanks.

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HEAVY DITCH CUTS—Ample clearance between the point of the blade and the front wheel permits proper ditching position with the new "Caterpillar" Diesel No. 12 Auto Patrol. No clogging or striking of front or rear tires!

FULL-REVOLVING BLADE—The blade of the new "Caterpillar" Diesel No. 12 Auto Patrol can be set entirely within the wheels . . . or turned completely around. You'll appreciate this full-revolving feature for working in reverse on subgrades or other jobs where the machine cannot be readily turned.

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Now the Diesel No. 12 takes its place beside the popular No. 10 and No. 11 Auto Patrols. Here, in this new machine, are *additional economies* for those who need still more power . . . more speed range . . . and more blade-scope than the other Auto Patrol models offer!

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Osborn, John Richard, College Station, Tex. (Age 29.) Graduate Asst. and Graduate Student, Dept. of Civ. Eng., Texas Agricultural & Mechanical College. Refers to J. T. L. McNew, J. J. Richey.

Osgood, Seth Phillips, Cleveland, Ohio. (Age 22.) Refers to G. E. Barnes, M. S. Douglas, G. B. Earnest, J. H. Herron, R. F. MacDowell, F. L. Plummer.

Page, Myron Ellsworth, Jr., Berkeley, Calif. (Age 22.) Refers to C. Derleth, Jr., F. S. Foote, C. G. Hyde, B. Jameyson, A. V. Saph, C. T. Wiskocil.

Peacock, Earl George, Columbia, Mo. (Age 24.) Refers to R. B. B. Moorman, H. Rubey, H. W. Wood, Jr.

Pennell, Robert Stewart, Kokomo, Ind. (Age 22.) Refers to C. A. Ellis, R. B. Wiley.

Perry, Stark Barnett, Montgomery, Ala. (Age 22.) Refers to G. J. Davis, Jr., D. C. A. du Plantier.

Pine, Edward Leonard, Reno, Nev. (Age 24.) Refers to F. L. Bixby, H. P. Boardman.

Powell, Richard Leigh, Dallas, Tex. (Age 23.) Refers to J. T. L. McNew, J. J. Richey.

Preusser, Roy Edward, St. Louis, Mo. (Age 23.) Refers to R. B. B. Moorman, H. Rubey.

Pride, Roland Wynns, Clay, Ky. (Age 22.) Refers to W. J. Carrel, W. W. Sanders, R. E. Shaver, D. V. Terrell, J. S. Watkins.

Reno, Henry Washington, Columbia, Mo. (Age 27.) Refers to R. B. B. Moorman, H. Rubey, H. W. Wood, Jr.

Rising, Robert Reynolds, Kansas City, Mo. (Age 20.) Refers to R. B. B. Moorman, H. Rubey, H. W. Wood, Jr.

Rose, Grover Donald, LaGrange, Ill. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Rowan, Lawrence, Chicago, Ill. (Age 25.) Refers to C. A. Ellis, R. B. Wiley.

Royer, Bruce Anderson, Morris, Ill. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Runyan, Damon Ogden, Kansas City, Kans. (Age 25.) Refers to C. L. Eckel, J. L. Harrington, O. H. Horner, W. E. Wilbur.

Rupley, Robert Leon, Plymouth, Ind. (Age 23.) Refers to C. A. Ellis, R. B. Wiley.

Schellhase, Harold Edward, Evansville, Ind. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Schlax, William Francis, Chicago, Ill. (Age 21.) Refers to L. E. Grinter, J. C. Penn, S. M. Spears.

Schraub, Malford Carl, Seguin, Tex. (Age 23.) Refers to J. T. L. McNew, J. J. Richey.

Schurman, Fred Girard, Indianapolis, Ind. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Sheehy, Patrick Joseph, Chicago, Ill. (Age 26.) Jun. Engr. (Civ.), Federal Power Comm. Refers to H. L. Bowman, F. W. Hough, S. J. Leonard, T. J. Mitchell, P. A. Perrin.

Sheets, Frank Thomas, Jr., Chicago, Ill. (Age 22.) Refers to C. A. Ellis, R. B. Wiley.

Shinkle, William Henry, Denver, Ill. (Age 23.) Refers to C. A. Ellis, R. B. Wiley.

Shipman, Roy Marvin, College Station, Tex. (Age 21.) Refers to J. T. L. McNew, J. J. Richey.

Simon, Bernard Daniel, Jr., Columbia, Mo. (Age 21.) Refers to R. B. B. Moorman, H. Rubey, H. W. Wood, Jr.

Simpson, Willard Eastman, Jr., San Antonio, Tex. (Age 22.) Refers to J. T. L. McNew, J. J. Richey.

Singleton, John Bernard, Vosburg, Miss. (Age 25.) Refers to G. J. Davis, Jr., D. C. A. du Plantier, S. C. Houser.

Snow, Martin Joseph, Santa Barbara, Calif. (Age 23.) Refers to S. T. Harding, C. T. Wiskocil.

Staley, Jack Arlonzo, Ft. Worth, Tex. (Age 20.) Refers to J. T. L. McNew, J. J. Richey.

Stearns, Stephen Russell, Manchester, N.H. (Age 23.) Refers to F. W. Garran, W. P. Kimball.

Symns, Clarence, Jr., Akron, Ohio. (Age 28.) Inspector and Chf. of Party, Ohio Dept. of Public Works, Nimisila Reservoir, project. Refers to F. E. Ayer, J. W. Bulger, M. L. Davis, R. C. Durst, L. L. Schmucker, S. G. Swigart.

Teas, John Glen, Russellville, Ala. (Age 22.) Refers to G. J. Davis, Jr., D. C. A. du Plantier, S. C. Houser.

Thoma, Edward Charles, Chicago, Ill. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Thomas, Ervin Linwood, Pleasantville, N.J. (Age 26.) Refers to G. J. Davis, Jr., D. C. A. du Plantier.

Thomas, Lloyd Leslie, Los Angeles, Calif. (Age 25.) Refers to R. E. Davis, F. S. Foote.

Thornburg, Alvan Ziegler, Whittier, Calif. (Age 22.) Refers to F. S. Foote, C. T. Wiskocil.

Turner, Ralph Edward, Frankfort, Ind. (Age 22.) Refers to C. A. Ellis, R. B. Wiley.

Tuttle, James Mason, Chattanooga, Tenn. (Age 23.) Refers to H. B. Aikin, R. T. Brown, H. W. Dougherty.

Vargas, Carlos Guillermo, Barranquilla, Colombia, S.A. (Age 27.) Refers to E. D. Dake, A. A. Chenoweth.

Waling, Joseph Lee, West Lafayette, Ind. (Age 22.) Refers to C. A. Ellis, R. B. Wiley.

Warrick, Wilson Hanly, Celina, Ohio. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Weeshoff, Gerard Christian, Santa Barbara, Calif. (Age 24.) Refers to C. G. Hyde, B. Jameyson, C. T. Wiskocil.

West, George William, Anna, Tex. (Age 21.) Refers to J. T. L. McNew, T. A. Munson.

Wheeler, Harry Paul, Columbia, Mo. (Age 23.) Refers to R. B. B. Moorman, H. Rubey, H. W. Wood, Jr.

Wilken, Robert Henry, Berkeley, Calif. (Age 23.) Refers to B. A. Etcheverry, H. L. Haehl, S. T. Harding, G. L. Henderson, Jr., F. C. Scobey.

Wright, John Urquhart, San Francisco, Calif. (Age 22.) Gen. Eng. Dept., Standard Oil Co. Refers to S. B. Morris, E. C. Thomas, H. A. Williams.

Zehnder, Jack Eslie, West Los Angeles, Calif. (Age 24.) Refers to T. F. Chace, C. T. Wiskocil.

Affiliate

Buff, Louis Frederic, Boston, Mass. (Age 62.) Pres. and Gen. Mgr., Buff & Buff Mfg. Co., also Pres., Babson-Dow Mfg. Co., Ranfall Faichney Corporation and Heinrici Mfg. Co. Refers to C. B. Breed, A. Haertlein, J. W. Howard, W. J. Keefe, J. D. Mitsch, E. Wright.

Symons, George Edgar, Buffalo, N.Y. (Age 35.) Chf. Chemist, Buffalo Sewer Authority. Refers to H. E. Babbitt, J. J. Doland, J. K. Giesey, S. A. Greeley, P. Hansen, E. P. Lupfer, J. R. Rumsey.

FOR TRANSFER

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Colburn, Robert Talbot, Assoc. M., Knoxville, Tenn. (Elected Junior April 7, 1924; Assoc. M. April 28, 1933.) (Age 37.) Constr. Plant Engr., TVA. Refers to A. J. Ackerman, R. W. Burpee, H. A. Hageman, T. B. Parker, L. N. Reeve, D. M. Wood.

du Plantier, Donald Cecil Allard, Assoc. M., University, Ala. (Elected July 15, 1929.) (Age 37.) Associate Prof. of Structural Eng., Univ. of Alabama. Refers to G. J. Davis, Jr., D. Derickson, B. H. Grehan, H. H. Houk, S. C. Houser, A. C. Polk, W. N. Woodbury.

Garrett, Roy Stuart, Assoc. M., Montgomery, Ala. (Elected Feb. 25, 1924.) (Age 43.) Asst. City Engr. Refers to D. H. Barber, W. H. Caruthers, H. H. Houk, R. D. Jordan, J. H. Mayer, G. N. Mitcham, S. B. Slack, H. C. Wells.

Lund, George Alfred, Assoc. M., New York City. (Elected Nov. 7, 1894.) (Age 69.) Retired. Refers to H. G. Balcom, W. W. Chapin, C. F. Chase, R. L. Gifford, G. E. J. Pistor, J. E. Wadsworth, A. Weymouth.

Meyer, Adolf Arnold, Assoc. M., Knoxville, Tenn. (Elected Dec. 15, 1924.) (Age 43.) Civ. Engr., TVA on Tennessee River hydro developments. Refers to P. E. Gisiger, J. V. Hogan, C. E. Nichols, A. L. Pauls, R. M. Riegel, J. A. Walls.

Plock, Henry John, Assoc. M., Mineola, N.Y. (Elected Nov. 28, 1932.) (Age 38.) Instructor of drafting, Coll. of City of New York; also Cons. Engr. on reinforced concrete work. Refers to H. G. Balcom, J. L. Edwards, R. E. Goodwin, L. R. Hjorth, G. A. Sallans, L. W. Weed, A. J. Wilcox.

Scott, Robert Graham, Assoc. M., Chicago, Ill. (Elected Dec. 22, 1930.) (Age 39.) Vice-Pres. and Cons. Engr., Clay Products Association, in charge of all engineering activities. Refers to J. G. Bennett, L. E. Conrad, W. J. Schlick, C. H. Scholer, J. W. Shikles, W. M. Spann.

Verduin, Abraham, Assoc. M., Charleston, S.C. (Elected July 15, 1929.) (Age 43.) Res. Engr., The Tilt-Hargan Co. Refers to A. Haring, G. Hewitt, E. M. Lee, C. H. Snow, G. E. Tilt, R. von Fabrice.

Wilkerson, William Wadsworth, Assoc. M., Goldthwaite, Texas. (Elected Nov. 11, 1929.) (Age 36.) Res. Engr. Texas State Highway Dept., in charge of construction in San Saba and Mills Counties. Refers to H. E. Elrod, E. N. Gustafson, J. T. L. McNew, J. M. Nagle, W. J. Powell, J. J. Richey.

. From the Grade of Junior

Aultman, William Whitescarver, Jun., Los Angeles, Calif. (Elected Oct. 26, 1931.) (Age 32.) Asst. Engr., Hydrographic Div., Metropolitan Water Dist. of Southern California. Refers to R. B. Diemer, C. C. Elder, J. Hinds, E. M. Kelly, F. Thomas, F. E. Weymouth.

Bergman, Victor Robinson, Jun., New York City. (Elected June 14, 1937.) (Age 31.) Estimator and Engr. with Godwin Constr. Co.; Instructor (evening session), School of Technology, Coll. of City of New York. Refers to H. M. Bergman, R. E. Goodwin, H. T. Immerman, C. B. Spencer, W. H. J. Vollmer.

Carden, Leo Franklin, Jun., Gallup, N.Mex. (Elected Oct. 14, 1930.) (Age 32.) Div. Engr. with Soil Conservation Service in Arizona. Refers to W. G. Bratschi, G. F. Conroy, N. B. Conway, L. C. Rockett, D. G. Shockley, F. W. Slattery.

Cutler, Ralph Waldo, Jun., Pasadena, Calif. (Elected, Nov. 11, 1929.) (Age 32.) Structural Engr. and Sales Engr., Erection, Mech. & Production Depts., Western Pipe & Steel Co. Refers to W. H. Cates, B. A. Hill, T. G. MacCarthy, R. R. Martel, R. J. Reed, M. U. Serrurier, F. Thomas.

Floras, Christos Lazare, Jun., Athens, Greece. (Elected Oct. 24, 1932.) (Age 32.) Tech. Eng. Adviser, Ministry of Hygiene; also Prof. of San. Eng. Div. of School of Hygiene. Refers to H. G. Baity, G. A. Halkiopulos, T. Saville. (Applies in accordance with Sec. I, Art. 1, of the By-Laws.)

Foehrenbach, Frank Augustus, Jun., Ensenada, Puerto Rico. (Elected Jan. 28, 1935.) (Age 32.) Civ. Engr., South Porto Rico Sugar Co. Refers to C. Crandall, D. O. Hepburn L. M. Leisinger, J. E. Perry, C. L. Walker.

Gossett, Franklin Rice, Jun., Palatka, Fla. (Elected Nov. 14, 1927.) (Age 32.) Jun. Hydrographic and Geodetic Engr. on air-photo planimetric map compilation, U. S. Coast and Geodetic Survey. Refers to F. S. Borden, L. O. Colbert, J. T. Jarman, F. L. Peacock, L. P. Raynor, G. T. Rude, P. A. Smith.

Karakiz, Socrates Michael, Jun., Chicago, Ill. (Elected March 5, 1928.) (Age 32.) Engr., Commonwealth Edison Co. Refers to J. G. Bennett, H. F. Janda, D. W. Mead, F. E. Turneaure, L. F. Van Hagan, H. E. Young.

Lewin, Joseph David, Jun., New York City. (Elected Nov. 18, 1935.) (Age 32.) Hydr. Designer, Phoenix Eng. Corporation. Refers to E. W. Bowden, C. W. Dunham, A. Hedefine, A. T. Larned, W. J. Shea, L. A. Whitsit.

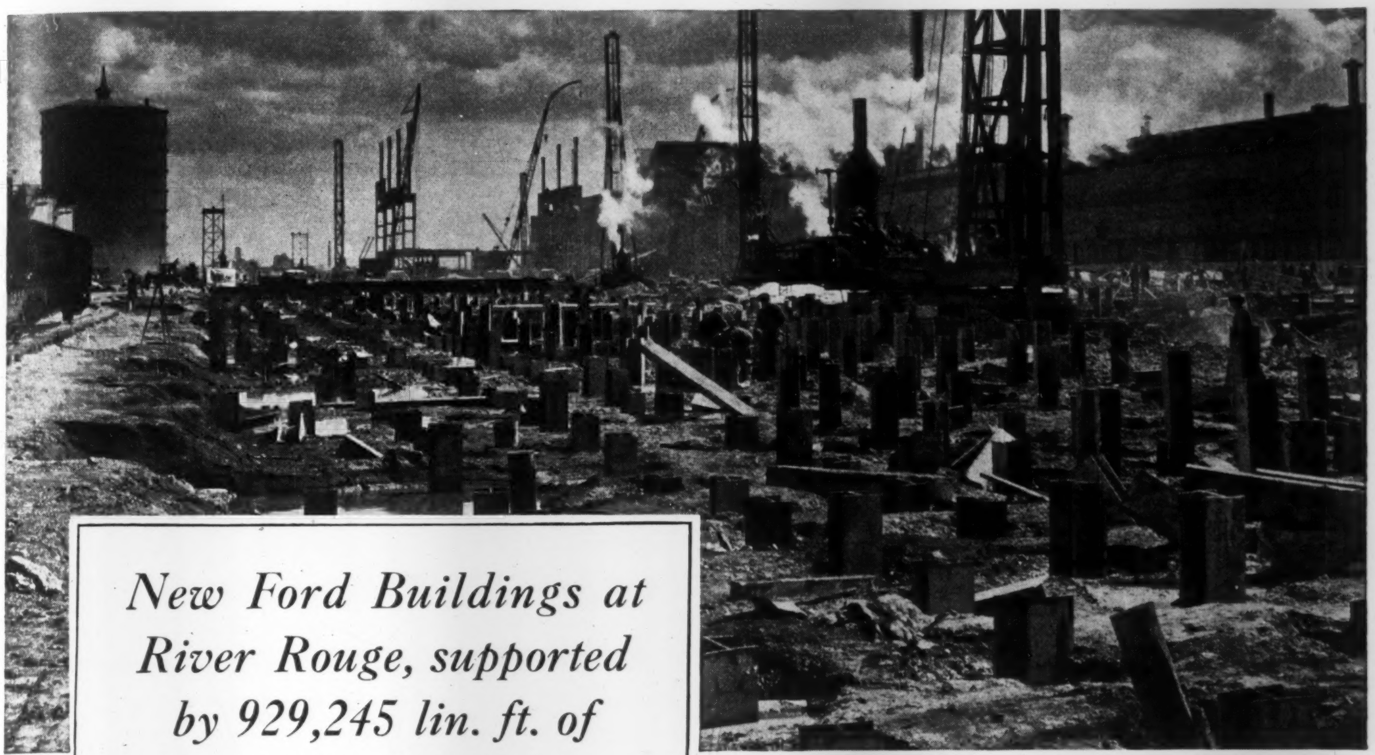
Noe, Thomas Pasteur, Jr., Jun., Greensboro, N.C. (Elected Feb. 10, 1930.) (Age 32.) Engr., Carolina Steel & Iron Co. Refers to H. G. Baity, T. F. Hickerson, A. E. Johnson, R. M. Trimble, S. R. Webb.

Parker, Charles Victor, Jun., Little Rock, Ark. (Elected Oct. 26, 1931.) (Age 31.) Jun. Engr., U. S. Engr. Office. Refers to V. M. Cone, D. H. McCoskey, J. M. Montz, C. T. Morris, G. R. Schneider, C. E. Sherman.

Thuring, Adolph Carl, Jun., Ft. Peck, Mont. (Elected May 11, 1936.) (Age 32.) Asst. Engr., U. S. Engr. Dept., Ft. Peck Dam. Refers to C. R. Brown, E. F. Chandler, P. A. Harper, C. Kittrell, T. B. Larkin, E. G. Plank, J. R. Thatcher.

The Board of Direction will consider the applications in this list not less than thirty days after date of issue.

WORLD'S *Biggest* STEEL BEARING PILE JOB



New Ford Buildings at River Rouge, supported by 929,245 lin. ft. of U·S·S STEEL BEARING PILES

DOWN THEY GO! A total of 8121 Steel H-Piles support the foundation of the new press plant at River Rouge. More than 800,000 lin. ft. of bearing piles will go into the foundation of this building alone. Foundations for the tool and die shop, hot mill extension and mill transfer building will require about 100,000 lin. ft. of piles in addition. Designed to be driven without splicing, the piles used, 12-in. CBP Section 124, are rolled in single lengths up to 105 feet, weigh 53 lb. per lin. ft. and will carry 55 tons per pile. (Piles load tested to 275 tons—the yield point of the steel.)

If the Carnegie-Illinois Works in Homestead, Pa., aimed its rolls at Dearborn, Mich., and rolled out one continuous pile 929,245 feet long, it would extend 176 miles across Pennsylvania, Ohio and Lake Erie or almost nine-tenths of the distance to the Ford Motor Company's new plant extension. That's a rough idea of the enormous amount of Steel H-Piles driven to provide permanent foundation for the new buildings of the Ford Motor Company's $40,000,000 expansion program.

Time was important on this job. Ultimate costs even more so. For these reasons, Steel H-Piles were selected. Time-saving factors, characteristic advantages of Steel H-Piles speeded up installation and insured the rapid progress essential to economy. Their high load capacity reduced the number of piles required to carry the load—meant fewer piles to drive. Individual piles were handled more rapidly because the single long-lengths made splicing unnecessary—meant fewer pieces to handle. Easier driving and absence of "heaving" further increased speed and reduced costs.

Here again, on this project, which sets a world's record as the greatest lineal footage of steel bearing piles driven on a single undertaking, Steel H-Piles illustrate the two important and outstanding advantages they offer foundation designer and construction engineer; first, steel sections specially designed to offer the strongest, most permanent, most easily driven form of bearing pile you can use; and second, an unfailing dependable source of supply that makes them immediately available regardless of the size or location of the job.

U·S·S STEEL BEARING PILES

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh USS *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 117 of the 1938 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Construction or Consulting Engineer; M. Am. Soc. C.E.; 54; married; 25 years as superintendent or manager on river, dam, tunnel, conduit, irrigation, and drainage projects. Experienced in work simplification, organization, plant requirements, estimates, design, reports, and investigations. Interested in long or short assignments anywhere. C-360-301-A-3-San Francisco.

Construction Engineer, Estimator; Assoc. M. Am. Soc. C.E.; 41; single; B.S.C.E., Michigan; 8 years estimating and handling subcontracts, all types of large buildings; 3 years on highway layout and construction; 8 years in design and construction, buildings and bridges. Fine personality and initiative. Ready to accept responsibility. Available at once. C-364.

Construction Engineer; Jun. Am. Soc. C.E.; 32; B.S. in C.E. Registered West Virginia; married; 8 years as estimator, inspector, and superintendent—foundations, roads, residential structures, federal buildings; two years as transitman and chief of party on land surveys and ground control for aerial mapping. Location in the East. Available immediately. Desires position with contractor or engineering firm. C-365.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 35; married; 4 years engineering surveys; 2 years engineering cost accountant; 7 years in general construction on roads, bridges, sewer and water systems; 3 years in business for self as consulting engineer, contractor, and builder. Desires permanent connection. Location immaterial. C-369.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 28; A.B.B.S., Columbia University; married. Desires position with consultant or contractor. Experience consists of building construction and estimating, surveying, costs and progress reports, contractors' engineer and superintendent on road, bridge, sewer, and waterworks projects. Designed timber falsework for rigid-frame reinforced concrete bridge. C-371.

Design

Civil Engineer; Assoc. M. Am. Soc. C.E.; 31; married; B.S.C.E.; registered. Now employed on hydroelectric program, planning and preliminary design of dams; 10 years experience in structural and hydraulic design, topographic mapping, and municipal works. Prefers location in North or West. Available on reasonable notice. C-363.

Executive

Civil Engineer; M. Am. Soc. C.E.; 46; married; B.S.C.E., 1911, C.E. 1924, Georgia Institute of Technology; registered Georgia; 27 years as engineer and executive on railroad construction, maintenance, and valuation; practitioner before Interstate Commerce Commission; private practice, appraisals, investigations, inspections, reports, statistical studies, historical research, writing; park and parkway developments; Corps of Engineers; senior administrative officer, Dept. of Interior. Southeast preferred. Short notice. C-366.

Water Works Designing, Construction, and Operating Engineer; M. Am. Soc. C.E.; registered in Pennsylvania and West Virginia; 27 years experience with public utilities. Can handle design, purchase of materials and equipment, construction, and placing in operation. Evaluation experience with public utilities and public service commission. Available. Location anywhere. C-372.

Civil Engineer; Assoc. M. Am. Soc. C.E.; university graduate, 1925; 38; married. Sound combination of designing, estimating, construction, and executive experience in Canada and abroad. Knowledge of accountancy. Desires permanent position with firm operating in a British country. (Applicant British subject.) Available shortly. C-374.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., New York University; 15 months experience in water-supply shaft, tunnel construction, and sewage disposal system as engineering inspector and estimator; 22 months experience in highway engineering, including surveying, estimating, drafting. Desires position with engineering or contracting firm. Available immediately. Good references. C-361.

Engineer; Jun. Am. Soc. C.E.; University of Pittsburgh, 1937; Sigma Tau; Scabbard and Blade; 23; single. Desires position with future in bridges or hydraulics. One years experience as calculator, draftsman, and surveyor in highway, sewerage, and land surveying work. Possesses tact and pleasant personality. Location immaterial. Available on short notice. C-367.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; civil engineering degree, Rensselaer Polytechnic Institute; varied experience in general contracting and engineering—inside as estimator and handling general office routine, field work as engineer and works superintendent in charge of building construction. Desires permanent position with future, not necessarily in construction. Location immaterial. Available immediately. C-370.

Miscellaneous

Hydraulic and Sanitary Engineer; M. Am. Soc. C.E.; 25 years experience, consulting and government positions, in responsible charge of all phases of water-supply engineering, sanitation, flood control, appraisal, malaria control, sewerage, dams, etc. Available immediately. Best references. C-368.

Teaching

Civil Engineer; M. Am. Soc. C.E.; 37; now in responsible charge of dam construction, including placing and testing a million yards of rolled earth fill. Desires teaching position in civil engineering department of university, with opportunity for work in soil mechanics. Location immaterial. Available in September. C-362.

Assistant Professor, mechanics, graphics, structures, reinforced concrete, surveying, geology, and drawing; Jun. Am. Soc. C.E.; 31. Teaching experience: 10 years (evenings, Saturdays), civil engineering subjects; 8 seasons, instructor, surveying camp. Professional experience: one year, foundation engineer; 4 1/2 years, structural designer; 1 1/2 years, concrete designer; one year, transitman (city surveyors). B.S.C.E.; M.S. (geology); P.E. & L.S. Available in September. C-373.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 108 of the Year Book for 1938. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Army Engineering, 5 ed. By W. A. Mitchell. Washington, D.C., Society of American Military Engineers, 1938. 329 pp., illus., diagrs., charts, tables, 7 × 4 in., leather, $3.

"Army engineering" designates that part of military engineering not included in fortification. As a consequence, this U. S. Military Academy textbook covers mapping, roads, railways, bridges, camouflage, explosives, gasoline engines, power plants, chemicals, and river and harbor engineering from the point of view of military operations.

Chinese Bridges. By H. Fugl-Meyer. Shanghai, Hong Kong, Singapore, Kelly and Walsh, Ltd., 1937. 138 pp., illus., diagrs., 9 × 6 in., cloth, $5 (also K. Paul, London, 9s.).

Descriptive information on old Chinese bridges, including stone and wooden trusses, stone and brick arches, wooden cantilevers, and rope and chain suspension bridges, is given in this volume. Historical notes, superstitions, and the results of some bending tests on stone beams are also included.

From Plan to Reality, Two, Edited by the staff of the Regional Plan Association. New York, Regional Plan Association (400 Madison Ave.), 1938. 95 pp., illus., diagrs., maps, charts, tables, 12 × 9 in., cloth, $2.

Describes the developments carried out according to the "Regional Plan of New York and Its Environs," particularly during the past four years, with a general summary of the last eight years. Highways and parkways, rail and air transportation and other public services, parks and reservations, and the organization for future planning are covered. Maps, diagrams, and photographs illustrate the text.

Great Britain. Dept. of Scientific and Industrial Research. Building Research Technical Paper No. 20. London, His Majesty's Stationery Office, 1938. 111 pp., illus., diagrs., charts, tables, 10 × 6 in., paper, 3s. (obtainable from British Library of Information, 270 Madison Ave., New York, 95 cents).

For a number of years the Department, with the cooperation of the Institution of Civil Engineers, has been studying stresses. The outcome of these investigations has been the formulation of a theory which explains the phenomena observed and makes it possible to construct charts for the guidance of engineers in safeguarding the pile from excessive stresses. The theory will also assist in diagnosing the cause of failures. The theory is presented in this pamphlet, together with recommendations concerning the manufacture, handling, and driving of reinforced concrete piles, based upon the investigations.

Great Britain. Dept. of Scientific and Industrial Research. Water Pollution Research Technical Paper No. 7. Estuary of the River Mersey. London, His Majesty's Stationery Office, 1938. 337 pp., diagrs., charts, maps, tables, 13 × 8 in., cloth, £1 10s. (obtainable from British Library of Information, 270 Madison Ave., New York, $7.75).

In 1932 the Department of Scientific and Industrial Research undertook an investigation of the possible effects of discharging untreated sewage into the estuary of the river Mersey upon the amount and hardness of the deposit in the estuary. The investigation was completed in 1937, and the methods and conclusions are now available in this report which is of interest to students of sedimentation generally. So far as this case was concerned, the sewage discharge was found to have no appreciable effect.

Die Hochwasservoraussage. By J. Wallner. Berlin, Julius Springer, 1938. 65 pp., diagrs., charts, tables, 11 × 7 in., paper, 7.50 rm.

This little book aims to provide practical directions for flood prediction. The first section describes present methods and discusses their uses, while the second section presents a method which is intended to be exact and generally applicable.

Isaac Newton 1642–1727. By J. W. N. Sullivan, with a memoir of the author by C. Singer. New York, Macmillan Co., 1938. 275 pp., 9 × 6 in., cloth, $2.50.

The purpose of this biography has been to paint a clear picture of Newton, the man, stressing the events which influenced his career, and to throw light on his character. His scientific achievements are discussed, particularly with reference to their relation to the contemporary scene and subsequent developments.

(A) Practical Treatise on Chimney Design. By D. A. Molitor. Detroit, Peters Co. (243 W. Congress St.), 1938. 123 pp., tables, diagrs., charts, 9 × 7 in., paper, mimeographed, $2.50.

A comprehensive treatise on the structural stability and practical design of chimneys. General factors relating to selection of types and materials, theoretical stress analysis, and chimney foundations are covered in the first few chapters. Then follow three chapters treating, respectively, brick, reinforced concrete, and steel types. Comparative design data and costs are given for corresponding chimneys in the three materials. Chimney builders are listed.

ANOTHER GOOD ROAD MADE BY GOOD ENGINEERING AND GOOD PRODUCTS

SOCONY
STANDARD
BRAND
SOCONY
ASPHALTS
AND
ROAD OILS

Applying Socony Asphalt, Standard Brand, Kenfield Federal Housing Project, Buffalo, N.Y.

Socony Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Socony Asphalt Emulsions • *Specifications and all other particulars furnished on request.*

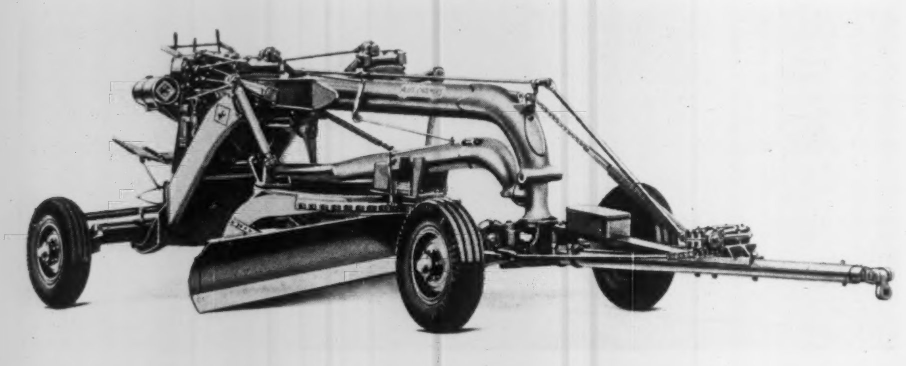
SOCONY-VACUUM OIL CO.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Allis-Chalmers Graders

Two models of the new line of graders, the numbers 110 and 112, being manufactured by the Tractor Division of the Allis-Chalmers Manufacturing Co. of Milwaukee, Wis., were first shown to the trade in January of this year at the Road Show in Cleveland, O.



The outstanding construction feature of the machines is the patented Allis-Chalmers leaning frame, which is reported to give a wide range of efficient blade positions on the 360 deg rotation of the crank arms. The frame lean, and the long, fully shiftable rear axle give the machine very effective stability, and also enable the operator to concentrate the weight of the machine on the blade when desired. Operator comfort and ease of operation of the controls are accomplished by use of the frame lean, which provides a level spring-mounted platform, even though the rear axle is inclined on a 25 deg slope. Leaning wheels furnish additional stabilizing force to hold the grader on steep bank cutting and ditching positions.

Lift cases are mounted forward above the circle to eliminate the torsional deflection of the customary long shafts, and to provide easy accessibility. For standardization only two sizes of worm gears are used in each model, and self-aligning bearings on the gear cases prolong the life of the bearings and gears. Automatic brakes prevent the control shafts from creeping when the control clutches are disengaged. Pneumatic tires are the sizes and types successfully used for other construction purposes.

Hinged Door Floodlights

For floodlighting of construction projects and industrial yards, and similar areas, types AH-14, AH-16, AH-20, AVH-16, and AVH-20 floodlights have been designed by the Lighting Division of Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The same socket housing and mounting brackets are used on all type AH floodlights. The socket housing is heavy cast aluminum, attached to the reflector by four bolts and a heavy steel reinforcing cup. The mounting bracket is a galvanized steel bow for cross-arm mounting. Bases are available for slipfitter, pipe clamp, or flat surface mounting. The cast aluminum dust-tight and moisture-proof door is hinged at the bottom of AH reflector and at the top of AVH reflector. The reflector is spun from Alclad aluminum and is either etched for a wide beam or polished for a narrow beam and then treated by the Alzak process.

The lenses are of all plain, heavy stippled, high transmission, and heat resisting glass. AH-14 uses 300-watt PS-35 bulb or 500-watt PS-40 bulb. AH-16 and AVH-16 use 750 or 1,000-watt PS-52 bulb. AH-20 and AVH-20 use 750, 1,000, or 1,500-watt PS-52 bulb.

Yeomans Acquires Simplex

Yeomans Brothers Company of Chicago, Ill., builders of sewage and sludge pumps, now announce that they have acquired from the Simplex Ejector & Aerator Corp., also of Chicago, all patterns, drawings, engineering data, and the exclusive right to the use of the established trade name covering Simplex aerators, distributors, dosing siphons, combination aerators and settling tanks, and sludge division boxes and clarifiers. All of this equipment will now be manufactured in the Yeomans plant.

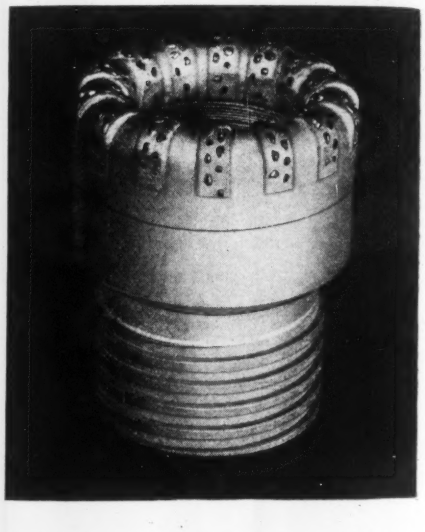
Lower Head and Moil Point for Concrete Breakers

The Quality Die Co. of South Chicago, Ill., are placing on the market a new Lower Head and a new alloy Moil Point without a collar for concrete breakers.

The new Quality Lower Head, three inches shorter than any head in service at the present time, is made of alloy steel and heat-treated to give years of service. Fitted into the head is a replaceable hardened and ground steel bushing. The key that holds the new Moil Point without a collar in the Lower Head, locks itself in place and will not vibrate out in service.

Core Drill Bit

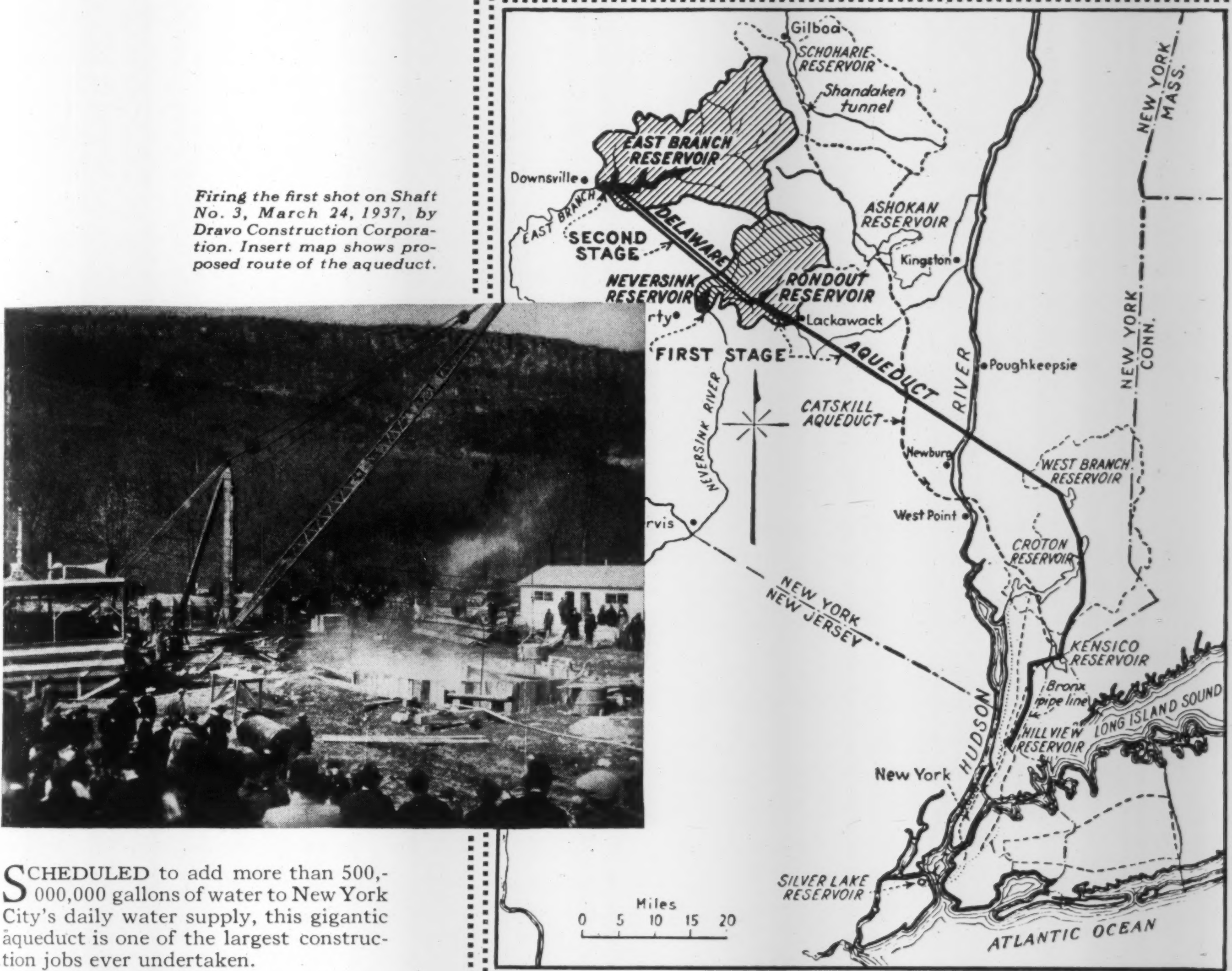
The Sullivan Machinery Co., Michigan City, Ind., has released literature descriptive of a new revolutionary type of core drilling bit, known as the Koebelite Korbit. In terms of bit cost per foot of hole drilled, savings of 15 to 20% are claimed in comparison with any other type of bortz set core drill bit. Faster drilling speed and greater footage per bit are also claimed.



Koebelite Korbits consist essentially of a number of bortz bearing inserts accurately located and firmly brazed into radial slots in the face of the bit blank.

By a patented process, the stone-bearing insert or metal matrix, and the stones, are moulded and integrally bonded together. Temperature changes cannot affect this bond. The manufacturer claims that because the stones are set in the inserts with mechanical precision in accordance with a definite field proven pattern, and because the inserts are located with close limit gages, an absolutely uniform contour gage is achieved which gives maximum cutting speed and insures straighter holes. These outstanding new bits are available in any style and size.

DU PONT HELPS DRIVE THE NEW DELAWARE AQUEDUCT PROJECT



Firing the first shot on Shaft No. 3, March 24, 1937, by Dravo Construction Corporation. Insert map shows proposed route of the aqueduct.

Gilboa
SCHOHARIE RESERVOIR
Shandaken tunnel
NEW YORK
MASS.
EAST BRANCH RESERVOIR
Downsville
EAST BRANCH
DELAWARE
SECOND STAGE
ASHOKAN RESERVOIR
Kingston
NEVERSINK RESERVOIR
RONDOUT RESERVOIR
rty
Lackawack
FIRST STAGE
AQUEDUCT
RIVER
Poughkeepsie
NEW YORK
CONN.
CATSKILL AQUEDUCT
NEVERSINK RIVER
Newburg
WEST BRANCH RESERVOIR
West Point
rvis
CROTON RESERVOIR
NEW YORK
NEW JERSEY
KENSICO RESERVOIR
Bronx pipe line
HUDSON
HILL VIEW RESERVOIR
LONG ISLAND SOUND
New York
SILVER LAKE RESERVOIR
Miles
0 5 10 15 20
ATLANTIC OCEAN

SCHEDULED to add more than 500,000,000 gallons of water to New York City's daily water supply, this gigantic aqueduct is one of the largest construction jobs ever undertaken.

The shafts alone for this 85-mile tunnel driven through solid rock will total 18,000 feet in vertical length.

On nearly all their work in sinking 10 of these shafts, the Dravo Construction Corporation, of Pittsburgh, used Du Pont Explosives.

Here is still *another* typical example of how modern contractors rely on Du Pont for *dependable* explosive performance under the most severe conditions. Du Pont Explosives are particularly adapted for tunnel and shaft work . . . where plasticity, good fumes, high shattering power and resistance to water are required.

But Du Pont offers *more* than dependable explosives and blasting accessories. Technical assistance and service on any blasting problem are outstanding Du Pont plus values always available to users of Du Pont Explosives. And Du Pont prompt delivery — regardless of quantity or location — does its part in keeping the job going. You can always get Du Pont Explosives *when, where* and as you want them.

E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department, Wilmington, Delaware

DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVES *and* BLASTING ACCESSORIES

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete. Reinforced Concrete Girder Bridges of Over 100 Ft Span, K. Hajnal-Konyi. *Concrete & Constr. Eng.*, vol. 33, nos. 1, 2, 4, and 5, Jan. 1938, pp. 43–47; Feb., pp. 104–109; Apr., pp. 203–213; and May, pp. 268–272. January and February: Theoretical discussion of principles and descriptive notes on 94 bridges of this type. April: Further essential data on 56 concrete-girder bridges in Europe and America. May: Evolution of large-span girder bridges.

Concrete Arch, New York. Flood-Proof Bridge for Binghamton, A. B. Cohen. *Eng. News-Rec.*, vol. 120, no. 17, Apr. 28, 1938, pp. 613–617. Design and construction of new highway on new Ferry St. bridge, Binghamton, N.Y., consisting of three $128\tfrac{1}{2}$-ft concrete barrel-arch spans with open spandrel floor construction, providing ample waterway for unusual floods; details of expansion joints across roadway and sidewalk over each pier, and of abutments of hollow buttress type with earth fill.

Concrete, Canada. Pressure Creosoted Composite Deck Bridges, J. Tate. *Can. Engr.*, vol. 73, no. 14, Oct. 5, 1937, pp. 11–13. Construction of short-span bridges at Port Arthur and Port William, Ontario, in which composite timber-concrete deck slab was used; shear developers; tests; concrete operations.

Concrete, Design. Gestaltungsgedanken fuer das Entwerfen von Eisenbetonbruecken, W. Neuffer. *Zement*, vol. 26, no. 34, Aug. 26, 1937, pp. 556–563. Design problems for planning of concrete bridges; selection of materials to meet modern requirements; advantages and methods of concrete construction; examples of notable concrete bridges.

Concrete, Seattle, Wash. Huge Reinforced Concrete Pontoon Bridge Proposed at Seattle. *Concrete*, vol. 46, no. 4, Apr. 1938, p. 6. Because deep foundations render fixed bridge impractical, pontoon highway bridge, 5,671 ft long—of reinforced concrete boxes each 309 ft long, 60 ft wide, and $19\tfrac{1}{2}$ ft deep—is suggested to provide adequate approach to city over Lake Washington.

Concrete Slab. Flat-Slab Types Used for California Highway Bridges, L. C. Hollister. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 188–190. Report on California Division of Highways studies, indicating that flat-slab construction is more economical than girder type for spans up to 30 ft; curve indicating crown thickness for continuous slab spans from 15 to 45 ft; characteristics; flat-slab designs for various spans; design charts; construction precautions.

Plate Girder, Argentine. Reconstruction of Mocoreta and Timboy Bridges, Argentine North-Eastern Railway, G. C. Blofield. *Instn. Civ. Engrs.—J.*, no. 6, Apr. 1938, pp. 527–544, supp. plates. Construction of two 3-span plate-girder railroad bridges, spans varying from 20 to 22 m in length; details of pile foundations; cost data.

Plate Girder, Denmark. Die Storstroem-Bruecke zwischen Falster und Seeland, T. von Rothe. *Zement*, vol. 26, no. 39, Sept. 30, 1937, pp. 649–653. Brief illustrated description of Storstroem Bridge connecting islands of Falster and Seeland, Denmark, with special reference to concrete foundation work. Similar descriptions indexed from various sources in *Engineering Index* 1937, p. 155.

Plate Girder, Kansas. Longest U. S. Girder at Topeka, J. Singleton. *Eng. News-Rec.*, vol. 120, no. 20, May 19, 1938, pp. 725–726. Design and construction of 5-span continuous deck plate-girder bridge of unusual proportions, with central span of 217 ft having maximum depth of 16 ft.

Plate Girder, Washington, D.C. Over 1,000 Ft of Continuity, H. J. Engel. *Eng. News-Rec.*, vol. 120, no. 18, May 5, 1938, pp. 651–653. Features of new Potomac River bridge now being built at site of old chain bridge at Washington, D.C., containing 8 continuous girder spans; structure is 1,351 ft long between abutments; links and bearings; structural details of continuous deck girders.

Steel Trestle, Widening. Adding 20 Ft of Width to Highway Bridge at Portland. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 197–199. Utilization of entire existing steel trestle, floor system, and concrete sidewalk slabs; toggle joint for connecting new floor beams in widening Union Avenue bridge over Sullivan gulch in Portland, Ore.; steel trestle extended by constructing rows of outside columns and moving each sidewalk 10 ft, permitting addition of two lanes without closing bridge traffic.

Steel Truss, Failure. Welded Bridge Failure in Belgium. *Eng. News-Rec.*, vol. 120, no. 18, May 5, 1938, pp. 654–655. Examination of cause of collapse, on March 14, 1938, of all-welded Vierendeel truss bridge of 245-ft span, near Hasselt, Belgium, revealing exceptional brittleness of both weld and parent metal.

Steel Truss, Vierendeel. Effondrement du pont de Hasselt sur le Canal Albert. *Annales de l'Institut Technique du Batiment et des Travaux Publics*, vol. 3, no. 2, Mar.-Apr. 1938, pp. 39–48. Description of collapse and analysis of causes of failure of welded steel Vierendeel bridge, with single span 74.52 m long, over Albert Canal, near Hasselt, Belgium.

Suspension, Design. Comment calculer des ponts suspendus? Bachet. *Annales de l'Institut Technique du Batiment et des Travaux Publics*, vol. 3, no. 2, Mar.-Apr. 1938, pp. 14–25. Theoretical mathematical discussion of theory of design of suspension bridges; discussion by H. Lossier and Bachet included.

BUILDINGS

Air Conditioning, Office Buildings. Comparative Analysis of Office Building Air Conditioning Systems, J. R. Hertzler. *Heating, Piping & Air Conditioning*, vol. 10, no. 5, May 1938, pp. 345–356. Each building warrants careful analysis and study, if proper system is to be installed to meet its requirements; group of large, complete office building air-conditioning systems is analyzed for comparative purposes; 10 buildings involving air-conditioned areas of more than 1,000,000 sq ft used for analysis. Before Am. Soc. Heating & Vent. Engrs.

Concrete Stadiums. Architectural Concrete Stadium Features Cantilever Roof, R. C. Reese. *Concrete*, vol. 46, no. 5, May 1938, pp. 3 and 4. Design and construction features of stadium, with special attention to roof construction, expansion joints, and form work.

Framed Structures, Steel. Steel Frame Is Designed for Light Load Buildings, J. E. Tufft. *Steel*, vol. 102, no. 4, Jan. 24, 1938, pp. 54–55. Example of use of steel framework in La Vina sanitarium, Pasadena, Calif., which is a one-story structure consisting of 8 attached and semi-attached units surrounded by lattice-steel pergolas; prefabricated steel frame used in walls, floor, and roof; system produces building which is wind, earthquake, and termite proof.

Steel Structures, Fire Resistance. Die Feuersicherheit der Bauten, etc., F. Hartmann. *Montanistische Rundschau*, vol. 29, no. 24, Dec. 16, 1937, (supp.) pp. 1–2. Fire resistance of structures and destruction by fire of rotunda in Vienna—large steel structure built in 1872 for world's fair; considerable wood was employed in its construction; steel cupola 108 m in outside diameter was supported by 32 steel columns; author's contention that proper steel construction has greater fire resistance than reinforced concrete is disputed in discussion by R. Saliger, pp. 3–4.

Termites, San Francisco. Termite Infestation in San Francisco, A. A. Brown. *Eng. News-Rec.*, vol. 120, no. 21, May 26, 1938, p. 748. Abstract of study leading to conclusion that menace of termites in United States is serious and widespread, but that construction planned to prevent their penetration could be carried out at additional cost of not more than from 1 to 2 per cent.

Vibration. Prevention of Vibration in Buildings, J. F. Smith. *Chartered Surveyors' Instn.—J.*, vol. 17, pt. 11, May 1938, pp. 223–240. Discussion of nature of vibration; spheres of sensibility; measuring instruments; practical building isolation from traffic vibration; machinery isolation; vibration insulating materials; methods of mounting machinery.

Walls, Dampness. Condensation. *Arch. Forum*, vol. 68, no. 4, Apr. 1938, pp. 20, 22–23, 24, and 64. Review of dwelling-house condensation troubles; based on studies by C. V. Teesdale and F. B. Rowley; condensation physics; dewpoint; diagrams showing theoretical dewpoints within four types of frame walls under three conditions of outdoor temperature; comparative test data; "Vapor Barrier" in typical frame walls.

CITY AND REGIONAL PLANNING

Alaska. Regional Planning. Part VII—Alaska, Its Resources and Development. Dec. 1937. Washington, D.C., Nat. Resources Committee (U. S. Gov. Printing Office), 1938. 213 pp., figs., diagrs., tables, 50 cents. Report of Alaska Resources Committee on problems in development of Alaska; development policies; planning recommendations; staff reports on population, meteorology, and climatology; mineral, wildlife, forest, and water resources; agriculture; water, air, and railroad transportation; roads; national defense.

Land Subdivision. Problems Created by Premature Subdivision of Urban Lands in Selected Metropolitan Districts, P. H. Cornick. Albany, N.Y., State of New York, Div. of State Planning, 1938. 346 pp., figs., diagrs., tables. Early subdivision booms and their consequences; extent of premature subdivision; premature subdivision and arrears of taxes; cost of government and land use; subdivision control under police power and through limitations on grants of power; cure and prevention of evils of premature subdivision. Bibliography.

Zoning. Zoning Administration in Relation to Building Inspection, H. P. Oram. *Bldg. Standards Monthly*, vol. 7, no. 4, Apr. 1938, pp. 4–5 and 11–13. Objectives of zoning; enforcement of zoning ordinance; zoning boards of adjustment; zoning experiences in Washington.

CONCRETE

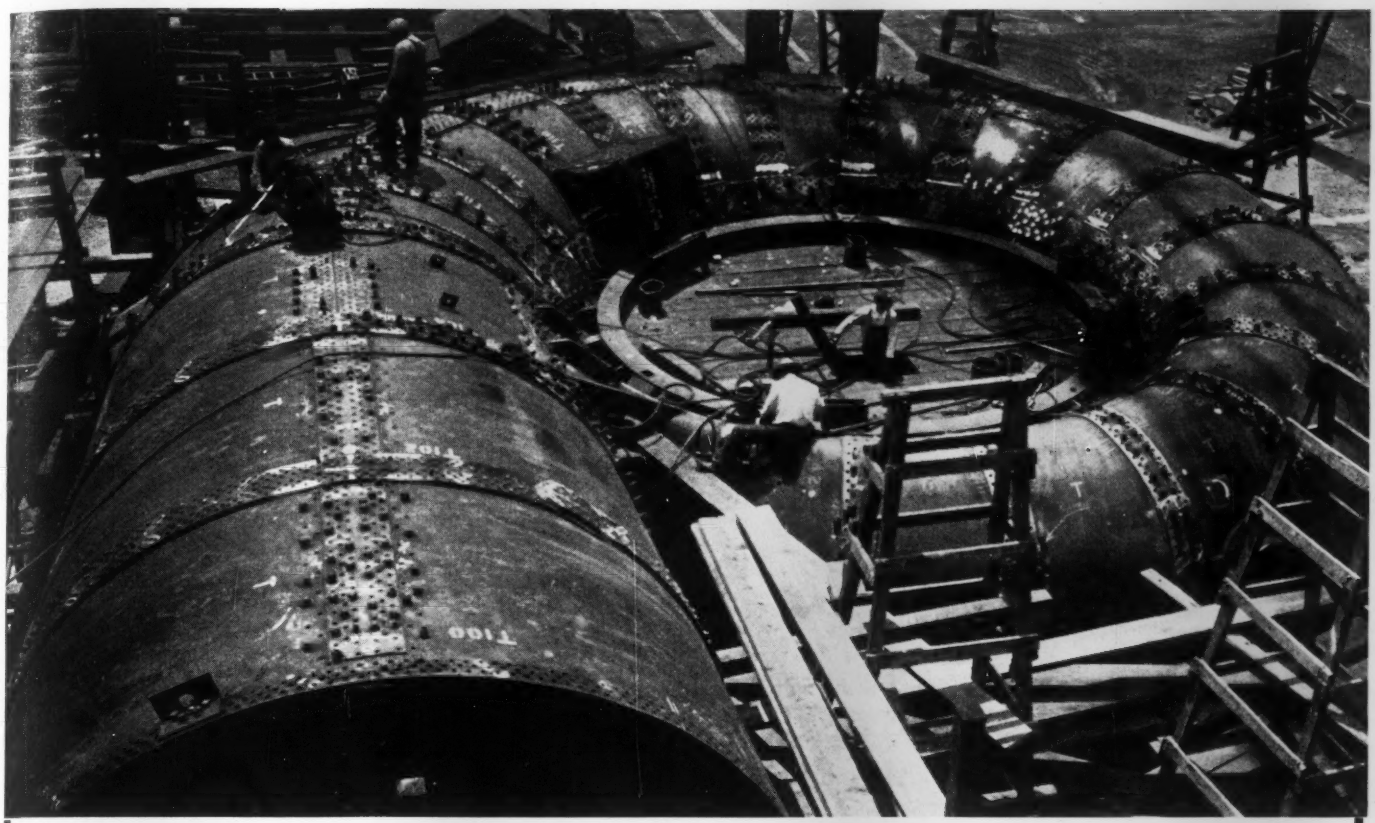
Brick Construction, Concrete Lining. Die Nachteile der Verkleidung alter Ziegelbruecken mit Schalen, R. Kern. *Bauingenieur*, vol. 18, no. 51/52, Dec. 24, 1937, pp. 801–805. Review of disadvantages of concrete lining of brick arches, piers, retaining walls, etc.

Bridges. Economical Use of Concrete in Highway Bridges, W. H. Thoman. *Concrete*, vol. 46, no. 5, May 1938, pp. 5 and 6. Economy depends upon selection of type as well as control of concreting operations; ways in which newer bridge types take advantage of continuity.

Construction. Architectural Concrete at Its Best in Three Great Buildings. *Concrete*, vol. 46, no. 4, April 1938, pp. 3 and 4. Review of practices in construction of three all-concrete exterior buildings for Sears, Roebuck & Company; placing methods and use of concrete forms.

Construction, Germany. Wiederaufleben des Stampfbetons, O. Colberg. *Beton u Eisen*, vol. 36, no. 22, Nov. 20, 1937, pp. 355–363. Review of development of concrete construction practice in Germany during last half century, with special reference to work of Eugen Dyckerhoff.

Dams, Temperature. Ueber die Sicherung der einheitlichen Mauerwirkung von Staumauern durch Kuehlmassnahmen, F. Toelke. *Beton u Eisen*, vol. 36, no. 18, Sept. 20, 1937, pp. 289–295. Study of temperature variations in mass concrete of high gravity dams in United States and Switzerland; effect of temperature variation on mass concrete; control of temperature variations by refrigeration installations.



Plant assembly of the spiral casing for the Flathead Development at Polson, Montana. Built for the Rocky Mountain Power Company

HYDRAULIC TURBINES

FRANCIS AND HIGH SPEED RUNNERS

PENSTOCKS - BUTTERFLY VALVES

POWER OPERATED RACK RAKES

GATES AND GATE HOISTS

ELECTRICALLY WELDED RACKS

Newport News Shipbuilding and Dry Dock Company
(Hydraulic Turbine Division)
Newport News, Virginia

Disintegration. Effect of Stored Merchandise on Concrete, F. W. Freise. *Concrete & Constr. Eng.*, vol. 33, no. 5, May 1938, pp. 245–248. Chemical damage to concrete equipment in industrial plants erected in Brazil for mechanical or chemical treatment of goods or storage of export merchandise, including cacao-beans, coffee, vegetable dyestuff, fibers, minerals (ores and coal), and tanning extracts.

Mixing. Control of Concrete, J. H. Knox. *Concrete*, vol. 46, no. 4, April 1938, pp. 33–35. Method described offers simple solution to proportioning problems and means of accurately determining amounts of materials to make homogeneous mass of satisfactory density and uniform, constant yield.

Pipe Lines, Coating. Coating of Concrete Maintains Corroded Pipe Lines. *Concrete*, vol. 46, no. 4, Apr. 1938, pp. 5 and 8. Description of machine which places coating of portland cement concrete or mortar on corroded pipe line without necessitating interruption of service during operation; results of some applications.

Pipe Lines, Protective Coatings. Coating Steel Water Pipe by New Concrete Machine, C. P. Harnish. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 59 and 60. Description of mechanical self-propelling device for applying outer concrete coating, 1 in. thick, to old 8-in. steel pipe line of Southern California Water Company; old main encased with small self-propelled machine riding pipe and leaving behind it finished concrete jacket; concrete placed in hopper is spread around pipe with revolving arms.

Tanks. Expansion Joints in Concrete Tanks, H. D. Dewell. *Eng. News-Rec.*, vol. 120, no. 19, May 12, 1938, pp. 687–688. Review of five-year operating record of refillable, floating plate type joints in water pretreatment plant of Sacramento, Calif.; tests of joint.

DAMS

Cofferdams, Wrecking. Wrenching Out Cofferdam, R. J. Jenks. *Eng. News-Rec.*, vol. 120, no. 19, May 12, 1938, pp. 677–679. Method of removing two cofferdams closing 60 acres of Columbia River used in construction of Grand Coulee Dam.

Concrete Gravity, California. Bigger Than Boulder. *Eng. News-Rec.*, vol. 120, no. 18, May 5, 1938, pp. 647–651. Plan for construction of Shasta concrete gravity dam in northern California, which is to contain 70 per cent more concrete than Boulder Dam and will be higher than Grand Coulee Dam, reaching maximum of 560 ft above lowest foundation; features of dam foundation and of overflow spillway section.

Concrete Gravity, Washington. Design and Construction of Dam Closure Gates. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 74–76. Design and construction of 4 gates (for diverting river from temporary diversion channels), built of timber, concrete, and steel in form of segment of cylinder, measuring 52 ft in height with chord of about 53 ft between centers of bearing members; arch construction; gate bottom details; buoyancy provisions; launching.

Concrete, Testing. Instruments Register Strains in Bonneville Dam Concrete, C. Robinson and G. Borkowski. *Elec. World*, vol. 109, no. 18, Apr. 23, 1938, pp. 59 and 60 and 134 and 135. Some 285 electric testing instruments are being used to measure stress, strain, and temperature in Bonneville Dam on Columbia River; entirely new data are being accumulated, making valuable addition to present knowledge of behavior of mass concrete.

Earth, Colorado. Construction Features of Taylor Park Dam, S. Poe. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 57–59. Construction of Colorado earth-and-rock-fill dam, 206 ft maximum height, located at elevation of 9,300 above sea level, supplementing storage for Uncompahgre Project; review of progress; earth testing laboratory for making all routine tests; spillway construction; hydrostatic pressure indicators; radio communication.

Gravity, Stresses. Shearing Stresses in Gravity Dams, S. Leliavsky. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1938, pp. 73–96, supp. plate. Methods in use, at present, for computation of shearing stresses in gravity dams; general formula for calculation of shearing stresses; new graphical method for computation of shearing stresses; static conditions in dam when reservoir is empty; application of general formula to other structures.

Great Britain. Burnhope Reservoir. *Water & Water Eng.*, vol. 39, no. 84, Oct. 1937, pp. 515–524. Construction of clay-core earth-fill dam with maximum height of 131 ft and length of 1,770 ft, forming 103-acre reservoir for Water Board of Durham County, England; features of shaft spillway 50 ft in diameter and other appurtenant structures.

Reservoirs, Concrete. Réservoir polytronàonique en béton armé de 16,000 m de capacité, à Cassis, P. Boutry. *Travaux*, vol. 22, no. 64, Apr. 1938, pp. 162–163. Features of new circular concrete water reservoir at Cassis, France, capacity 16,000 cu m, having sloping bottom consisting of number of radial, conical arches, surmounted with vertical concrete wall 3 m high.

Rock-Fill, Subsidence. Subsidence of Rockfill Dam and Remedial Measures Employed at Eildon Reservoir, Australia, R. G. Knight. *Instn. Civ. Engrs.—J.*, no. 5, Mar. 1938, pp. 111–191, (discussion) 192–208, supp. plates. Restoration of embankment, drainage of foundations, and remodelling of outlet works and spillway of Eildon concrete core rock-fill dam (137 ft maximum height, 3,259 ft long), which was completed in 1927 and partially failed in 1929; movement of dam, as shown by core-wall deflection; treatment of cracks.

Spillways, Design. Bissorte Dam Safety Spillway, M. A. Mason. *Boston Soc. Civ. Engrs.—J.*, vol. 25, no. 2, Apr. 1938, pp. 321–333. Features of so-called Danel design of additional spillway, with capacity of 100 cu m per sec, for Bissorte Dam in French Alps, based on tests of models representing new application of hydraulic jump; platform below spillway crest, forming secondary crest or sill, allows overflowing water to be collected and directed as desired.

United States. Dams and Control Works, 2 ed. Washington, D.C., U. S. Dept. Interior (Gov. Printing Office), Feb. 1938. 261 pp., figs., diagrs., tables. $1. Description of 15 storage dams and 6 diversion dams built by U. S. Bureau of Reclamation; also articles on high-pressure reservoir outlets; hydraulic model testing of structures, structural model testing of dams, concrete and earth materials laboratories operation, trial-load method of analyzing arch dams, temperature control of mass concrete in large dams, design and construction of small earth dams.

FLOW OF FLUIDS

Flow of Water, Sluices. Supplementary Notes on Flow Through Model Sluices, H. Addison. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1938, pp. 53–72. Mathematical analysis of Egyptian data on submerged sluice experiments; typical graphs for high-head and low-head sluices; transformation of results; free flow experiments on low-head and simplified high-head sluices; analytical treatment of free flow; interference effects under free flow and submerged flow conditions.

Porous Materials. Grundgesetze der Feuchtigkeitsbewegung in Trockenguetern, O. Krischer. *VDI Zeit*, vol. 82, no. 13, Mar. 26, 1938, pp. 373–378. Fundamental theory of penetration of moisture into dry porous materials; capillary movement of water and diffusion of water vapor; results of theoretical experimental study show that so-called coefficient of moisture is dependent upon moisture content, capillary distribution curve, and temperature.

Stream Flow. Open-Flow Hydraulics, F. W. Woods. *Engineering*, vol. 145, nos. 3757 and 3759, Jan. 14, 1938, pp. 30–32, and Jan. 28, pp. 83–86. Almost earliest formula devised to express relationship between mean velocity of streams in terms of depth, waterway, and declivity, is one still most commonly used; it is believed that difficulties experienced in application of this and other formulas arose from fact that it is not cast in form most suitable to conception of water flowing with constant velocity and uniform motion; it is sought to make this clear by analysis.

FOUNDATIONS

Raising. Surélévation de soubassement d'une église en Roumanie, E. Prager. *Travaux*, vol. 22, no. 64, Apr. 1938, pp. 164–166. Methods and equipment used in raising foundation of sixteenth century church at Rebegesti, Roumania, 3.5 m above its original level, to save it from being partly submerged by water of new storage reservoir; foundation is approximately 17.4 m by 6.9 m.

Underpinning. Examples of Underpinning of Heavy Structures, W. Muirhead. *Structural Engr.*, vol. 16, no. 5, May 1938, pp. 176–179. Discussion of paper previously indexed from issue of February 1938.

HYDRAULIC ENGINEERING

Hydraulic Structures. Le Reti Idrauliche, G. Supino. Bologna, Italy, Nicola Zanichelli Editore, 1938. 390 pp., figs., diagrs., tables. General text on hydraulics of water networks, including study of maximum rainfall and flood flow; hydraulic design of drainage, sewerage, and navigation networks; instruments for hydrological observations, stream gaging, and hydraulic measurements; construction of drainage, sewerage, and stream-control works.

Hydrodynamics. On Stability Problem in Hydrodynamics, C. L. Pekeris. *J. Aeronautical Sciences*, vol. 5, no. 6, Apr. 1938, pp. 237–240. It is shown that parabolic flow of viscous fluid between two fixed walls is stable for small disturbances which have symmetrical streamlines. Bibliography.

India. Summary of Annual Note on Experiments Carried Out by Irrigation Research Division During 1936–1937 at Lake Fife Hydrodynamic Research Station near Poona, C. C. Inglis, A. R. Thomas, and D. V. Joglaeker. *Bombay Pub. Works Dept.—Tech. Paper*, no. 58, 1938, 21 pp., supp. plates. 1s 2d. Notes on river models, model tests of weirs, sluices, standing wave flume, etc.; experimental studies of designs for dissipating energy below falls; experiments with silt abrader; flood runoff from catchments; bed silt of canals.

Research Laboratories, France. Dam and Bridge Laboratory. *Engineer*, vol. 165, no. 4282, Feb. 4, 1938, pp. 134–135. Illustrated description of design and equipment of laboratory at Office Nationale des Recherches et Inventions at Bellevue, near Paris; occupies building in floor of which valley in concrete has been formed, at sides of which is equipment whereby dam to be tested is placed under water or mercury pressure and its reaction to pressures measured; how problem of satisfactory means for handling mercury used in experiments was solved.

Water Hammer. Relief from Water Hammer, L. H. Kessler. *Am. Water Works Assn.—J.*, vol. 30, no. 1, Jan. 1938, pp. 15–37. Results of research at University of Wisconsin on fluid impact absorbers, or arresters, which demonstrated that new pneumatic device, which is reasonably simple in construction and operation, can be made; useful capacity of fluid impact arresters; effect of length on size of arrester required; effect of length when compound pipes are used; tables.

HYDROLOGY AND METEOROLOGY

Seismology. Fault Noises Studied as Possible Earthquake Warnings, W. D. Patterson. *Eng. News-Rec.*, vol. 120, no. 17, Apr. 28, 1938, pp. 626–627. Report on recent study of sounds, heard by listening devices, deep underground at fault zones in California, which may indicate impending seismic disturbances; description of special instruments used.

Virginia. Hydrology of Virginia—I, P. H. McGauhey. *Va. Polytechnic Inst.—Eng. Experiment Station Series—Bull. no. 33*, vol. 31, no. 6, Apr. 1938, 113 pp. Statistical data on annual rainfall and stream flow of Virginia; relation between rainfall and runoff; tabulated series of rainfall and runoff by river basins; outline of probability calculus and other statistical methods in analysis of data, including general statistical theory applicable to such analysis.

IRRIGATION

Underground Water, Tunisia. Exploitation des nappes d'eau souterraines en Tunisie, P. Bachy and E. Lenain. *Travaux*, vol. 22, no. 64, Apr. 1938, pp. 195–197. Review of hydrology of underground water supply of Tunisia and recent developments in discovery and utilization of rich artesian water supplies; use of rotary well drilling.

United States. Washington Office Functions of U. S. Bureau of Reclamation, W. R. Nelson. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 49–52. Review of organization and administrative work carried out at headquarters of U. S. Bureau of Reclamation; summary of Bureau activities.

PORTS AND MARITIME STRUCTURES

Brazil. Hafenbau Maceio (Brasilien), Herkner. *Bauingenieur*, vol. 18, no. 47–48, Nov. 26, 1937, pp. 741–743. Construction of new breakwater and pier in port of Maceio, Brazil, totaling nearly 20,000,000 milreis in cost.

Drydocks, India. Admiralty Graving Dock at Signapore. *Engineering*, vol. 145, no. 3761, Feb. 11, 1938, pp. 158–159; see also *Engineer*, vol. 165, no. 4284, Feb. 18, 1938, pp. 197 and 194. Dock is 130 ft wide at entrance and 1,000 ft long, capable of dealing with any ship in British Navy.

Hamburg, Germany. Hamburg's Progress During 1937, Koehn. *Naut. Gaz.*, vol. 128, no. 9, Apr. 23, 1938, pp. 6 and 7 and 16–17. Statistical data pertaining to exports and imports; changes which have taken place in nature of cargo handling; importance of Hamburg to Germany's foreign trade.

Lake Charles, La. Deep Sea Comes to Lake Charles. *Naut. Gaz.*, vol. 128, no. 10, May 7, 1938, pp. 8–9 and 16. Port of Lake Charles to be utilized as ocean service point; new route directly from Gulf of Mexico through Calcasieu Pass and then through Lake will bring port within 30 miles of ocean; administration and facilities; advantages of new route.

Warehouses, Germany. Die Erweiterung des Verteilungsschuppens im Hamburger Hafen, Bolle. *Bauingenieur*, vol. 18, no. 47/48, Nov. 26, 1937, pp. 737–741. Description of extension of warehouses in port of Hamburg, Germany; details of sheet piling, roof trusses, etc.

ROADS AND STREETS

Aggregates. Stabilized Aggregates, O. W. Merrell. *Rock Products*, vol. 41, no. 3, Mar. 1938, p. 47. Production of "Roadcrete" as manufactured by Roadcrete, Inc., at their Newton, Ohio, plant; stabilized aggregate is carefully designed and graded by sieve analysis to obtain maximum density; clay soil binder used with flake calcium

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ATLAS
EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

chloride to control moisture and eliminate dust; density test results.

Bituminous. Possibilities in New Crushed Stone Product—Bituminated or Bituminized Dust, H. O. Fraad. *Rock Products*, vol. 41, no. 4, Apr. 1938, pp. 50–52. Description of new pulverized stone product, which contains up to 20 per cent of bituminous binder but is dry and free running; applications and stabilizing effects; experiments with such product as road material in Switzerland.

California. System of Super Highways Proposed for Los Angeles. *Western Construction News*, vol. 13, no. 3, Mar. 1938, pp. 115–116. Outline of proposed system of multi-lane express motorways of Metropolitan District of Los Angeles, Calif., to be developed upon rights-of-way not less than 360 ft wide through residential territory, and not less than 100 ft wide through established business districts.

Canada. Highway Development in Canada, T. J. Mahony. *Can. Engr.*, vol. 73, no. 14, Oct. 5, 1937, pp. 19–21. Highway organization in Ontario; improved roads in Canada; Toronto-Hamilton highway; revenue from tourist traffic; trans-Canada highway.

Construction. Road Design Stepped Higher, C. H. Purcell. *Eng. News-Rec.*, vol. 120, no. 19, May 12, 1938, pp. 684–686. Review of recent Californian progress in design and construction of highways pointing out radical revision of standards made by state engineers to increase safety of higher speed travel.

Great Britain. Highway Design Problems in Great Britain, F. C. Cook. *Can. Engr.*, vol. 73, no. 13, Sept. 28, 1937, pp. 8–10. Comparative discussion of highway problems of Great Britain and Canada; road system in Great Britain; Macadam and Telford; ribbon development; highway design in Great Britain; dual roadways; paved cycle tracks.

Low Cost. Safe Fast Roads at Small Costs, W. O. Whipps. *Eng. News-Rec.*, vol. 120, no. 17, Apr. 28, 1938, pp. 621–624. Recent development of system of low-cost high-speed highways of Montana, including over 4,000 miles of roads with bituminous-treated gravel surface.

United States. Rural and Urban Contributions to Highway Travel and Expenditures, R. H. Paddock. *Pub. Roads*, vol. 19, no. 2, Apr. 1938, pp. 17–30. Comparative study based on analyses of highway financial problem accompanied by road use investigations made in Wisconsin in 1930, in Minnesota in 1933, and in Colorado and New York in 1934; comparisons of highway use and taxation; correlation between registrations, expenditures, and travel per mile of highway; basis for equitable highway taxation.

SEWERAGE AND SEWAGE DISPOSAL

Disposal Plants, Equipment. Maintenance of Sludge Collectors in Sewage-Treatment Plants, H. F. Watson. *Am. City*, vol. 53, no. 4, Apr. 1938, pp. 65 and 66. Main types of sludge collectors; lubricating speed reducers; motors; restarting of collector; shear pins for safety; slack in chains.

Disposal Plants, San Francisco. San Francisco Sewage Disposal Plant Introduces Latest Design Practice, J. J. Casey. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 71–74. Review of program of improvement in municipal sewage disposal now under construction; features of 25-mgd plant providing for sedimentation, sludge digestion, elutriation, vacuum filtration, and disinfection of effluent.

Hot Springs, Ark. Sewage Treatment at Hot Springs, Arkansas, T. R. Kendall. *Am. City*, vol. 53, no. 4, Apr. 1938, pp. 76–78. Special problems of sewage treatment at Hot Springs, Ark., owing to high temperature of sewage due to hot baths and constant flow of hot medicinal spring waters; description of two sewage-disposal plants.

Laboratories. Recent Laboratories for Large Sewage Treatment Works, E. Hurwitz. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 60–73. Features of design and equipment of some of larger sewage disposal laboratories that have been completed in United States in past two years or which are now in process of completion; area provided; special units; laboratory layouts; furniture, tables, and equipment.

New York. Ward's Island Sewage Treatment Project, W. D. Binger and R. H. Gould. *Mun. Sanitation*, vol. 8, no. 12, Dec. 1937, pp. 627–630 and 636–637. Design and construction of new 190-mgd sewage disposal plant at Ward's Island, New York City; flow diagrams; operating procedure; cost data; lists of major equipment in sewage disposal plants.

Refuse Disposal, Digestion. Dual Disposal of Sewage and Food Wastes. *Engineering*, vol. 145, no. 3759, Jan. 28, 1938, pp. 81–83, supp. plate; see also French abstract in *Gènie Civil*, vol. 112, no. 2903, Apr. 2, 1938, pp. 296–297. Illustrated description of experiments at Baltimore, Md., sewage works, with object of determining feasibility of grinding garbage in bulk quantities at strategically located plants and disposing of shredded material by means of sewer system, in conjunction with regular work performed by sewage-disposal plants.

Research. Research in Sewage Chemistry, Sewage Treatment and Stream Pollution, G. P. Edwards, C. A. Emerson, Jr., H. A. Faber, H. F. Gray, H. Heukelekian, W. Rudolfs, H. W. Streeter, and E. B. Phelps. *Sewage Works J.*, vol. 10, no. 2, Mar. 1938, pp. 173–208. Critical review of literature of 1937 on chemistry and biology of phenomena taking place in polluted streams, activated sludge, sludge digestion, chemical treatment of sewage, chlorination, industrial wastes, mechanical equipment, and stream pollution. Bibliography.

Sludge. Developments in Sewage Sludge Incineration, M. B. Owen. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 100–105. Features of 18 new American sludge incinerators; character of sludge; operating data; fuel oil; operating costs; effect of incineration on plant design.

Sludge. Viscosity or Pseudo-Plastic Properties of Sewage Sludges, W. D. Hatfield. *Sewage Works J.*, vol. 10, no. 1, Jan. 1938, pp. 3–25. Experimental study of viscosity of sewage sludge; experience with rotational viscometric method; viscous properties of sewage sludge; apparent viscosity of sewage sludge; application of laws of fluid flow to sewage sludge.

Viaducts, Underpinning. Sewer Construction Affects Tracks on Three Levels. *Ry. Age*, vol. 104, no. 17, Apr. 23, 1938, pp. 728–731. Complications involved in underpinning viaduct at Detroit, Mich., main feature of which was driving 1,200 steel piles to depths of 90 ft or more.

Water Pollution, Oxidation. Measures of Natural Oxidation in Polluted Streams—IV, R. W. Kehr. *Sewage Works J.*, vol. 10, no. 2, Mar. 1938, pp. 228–240. Effects of sewage on atmospheric reaeration rates under stream-flow conditions; experimental study of causes of lowered rates of atmospheric reaeration observed in tap water when admixed with sewage or sewage sludge; effect of temperature; effect of varying percentages of sewage on reaeration rate. Bibliography. See *Engineering Index*, 1936, p. 1198.

Wisconsin. Sewage-Treatment Projects on Lower Fox River, Wisconsin, S. A. Greeley. *Am. City*, vol. 53, no. 3, Mar. 1938, pp. 37–40. Features of recently completed sewage disposal plants of Kaukauna, Appleton, and Neenah-Menasha on lower Fox River, Wisconsin; oxygen balance of river; sludge-disposal equipment.

Z Process. Das "Z"-Verfahren als neuer Beitrag zur Abwasserreinigung, P. Zigerli. *Gesundheits-Ingenieur*, vol. 60, no. 32, Aug. 7, 1937, pp. 499–503. Outline of new so-called "Z" process of sewage disposal involving filtration through asbestos flakes; description and report on performance of experimental plant for study of this process, established at St. Gallen, Switzerland.

STRUCTURAL ENGINEERING

Beams, Bending. Stiffness of Beams, R. Fleming. *Eng. News-Rec.*, vol. 120, no. 14, Apr. 7, 1938, pp. 509–511. Theoretical discussion showing that stiffness, or resistance to bending, is dependent upon type of end supports, modulus of elasticity, moment of inertia, span length and load; shearing deflections; comparison of beams of uniform cross-section.

Beams, Continuous. Analysis of Elastic Structures, E. H. Bateman. *Engineering*, vol. 144, no. 3752, Dec. 10, 1937, pp. 669–671. Description of deformation energy method; table giving solution of continuous beam by remainder distribution presented. Before Sec. G. of Brit. Assn.

Ceilings. Flat Slab of Tile and Concrete. *Eng. News-Rec.*, vol. 120, no. 14, Apr. 7, 1938, pp. 511–512. Features of new type of construction used in Railway Exchange Building in Denver; this method known as "smooth ceilings system," consists of solid concrete slab around columns in areas of maximum negative moment, and clay tile fillers, spaced both ways, in middle strip areas.

Columns, Concrete, Design. Strength of Eccentrically Loaded Reinforced Concrete Columns, F. G. Thomas. *Concrete & Constr. Eng.*, vol. 33, no. 3, Mar. 1938, pp. 165–173. Theoretical mathematical discussion of C. S. Whitney's method of analysis of eccentrically loaded columns; calculation according to straight-line-no-tension theory; experimental results.

Concrete Design. Remarques sur les calculs de flexion simple dans le béton armé, Fonlladosa. *Travaux*, vol. 22, no. 64, Apr. 1938, pp. 175–184. Theoretical mathematical discussion leading to derivation of formulas and construction of graphical charts for design of reinforced concrete sections subjected to simple bending; design of stirrups; illustrative numerical examples.

Engineering Problems. Engineering Problems in Modern Architectural Design, R. I. James. *Instn. Engrs. & Shipbldrs. in Scotland—Trans.*, vol. 81, pt. 5, Mar. 1938, pp. 272–290, (discussion) 290–300. Common problems resulting from modern practice; functions of structural engineer as subservient to those of architect; increasing use of statically indeterminate forms.

Framed Structures, Design. Simplified Methods for Computing Stresses in Rigid Frame Buildings, S. A. Keast. Philadelphia, Pa., Lefax, Inc., Jan. 1938. 40 pp., figs., tables, diagrs. Outline of practical method for design of steel or concrete frames under action of wind or other lateral forces, such as considered in earthquake analysis; stresses due to vertical and to lateral loads; distribution of lateral loads; combining vertical and lateral moments; proof of formulas; numerical examples.

History. History of Theory of Structures, A. A. Fordham. *Structural Engr.*, vol. 16, no. 5, May 1938, pp. 154–163. Review of development of theory of structures and work of pioneers in structural engineering since middle of seventeenth century. Bibliography. Before Instn. Structural Engrs.

Soundproofing Buildings. Akustic und Schallschutz im Hochbau. (Sammlung Goeschen 1119), E. Michel. Berlin and Leipzig, Walter de Gruyter & Co., 1938. 157 pp., illus., diagrs., charts, tables, 1.62 rm. Treatise on acoustics and soundproofing of buildings; two main sections, one having to do with internal acoustics of rooms of varying shapes, and the other with effects and methods of exclusion of exterior noise, taking into account structural details. Eng. Soc. Lib., N.Y.

Wooden Construction. Le bois et la résistance des matériaux, J. Campredon. *Travaux*, vol. 21, no. 60, Dec. 1937, pp. 537–544. Review of special structural properties of wood; principles of design of wooden members; novel designs and methods of construction of wooden girders, arches, and frames.

TUNNELS

Air Conditioning. Ventilation of New Lincoln Tunnel. *Heating & Vent.*, vol. 35, no. 3, Mar. 1938, pp. 36–37. Pictorial description of air conditioning equipment and methods used in tunnel connecting 39th Street, New York City, with Weehawken, N.J.

Brick Paving. Severe Service Requirements Demand Brick for New Lincoln Tunnel Paving. *Brick & Clay Rec.*, vol. 92, no. 1, Jan. 1938, p. 17. Reasons for choice of vitrified brick over 15 other surface materials; approximately 26,000 sq yd of brick used; toughness and abrasion qualities.

Colorado River Aqueduct. Contractor's Equipment and Methods Used on Aqueduct Conduit. *Western Construction News*, vol. 13, no. 2, Feb. 1938, pp. 53–56. Description of work on Colorado River Aqueduct project; construction of 35,229 ft of conduit, extending east from San Jacinto Tunnel to connect with Whitewater tunnels; invert jumbo and concrete-placing equipment; aggregate and concrete preparation; design of arch forms; jumbo units used to move inside and outside panels in sections of 11 ft 8 in.

Lining. Schachtausbauten aus Spannbeton. *Beton u. Eisen*, vol. 36, no. 17, Sept. 5, 1937, pp. 281–282. Tunnel linings of pre-stressed concrete; use of inner ring of prefabricated pre-stressed concrete slabs in tunnel linings, subjected to external pressure and to freezing and thawing, serving as substitute for iron tubing in absence of any stable surrounding support.

Railroad, Germany. Der Geisingtunnel der neuen Vollspurbahn Heidenau—Altenberg (Erzgeb), Hildebrand. *Bautechnik*, vol. 15, no. 38, Sept. 3, 1937, pp. 481–487. Design and construction of single-track railroad tunnel, 236 m long, near Geising, Germany; drainage and waterproofing of tunnel; cost amounted to 2,280 marks per linear meter.

Railroad Signals and Signaling. Emploi de tubes luminescents comme compléments des signaux sous tunnels, R. Levi. *Revue Générale des Chemins de Fer*, vol. 56, no. 6, Dec. 1937, pp. 356–360. Use of luminescent tubes of mercury vapor as supplementary signals in railroad tunnels; experience of French railroads with such supplementary signals in tunnel near Rouen.

Ventilation. Ventilation Problems and Equipment for Twin 3,200-Ft Highway Tunnels, M. C. Collins. *Western Construction News*, vol. 13, no. 3, Mar. 1938, pp. 89–93. Ventilation plant for twin vehicular tunnels, 3,200 ft long, known as Broadway Low-Level Tunnels located on highway connecting Broadway, in Oakland, Calif., with highway in Contra Costa County; system designed for 1,200 cars per hour per traffic lane; carbon monoxide concentration held to 2.0 parts in 10,000; 16 fans have combined capacity of 1,500,000 cu ft per min.

Waterproofing. New Method of Waterproofing Subways and Tunnels. *Concrete & Constr. Eng.*, vol. 33, no. 4, Apr. 1938, pp. 214–218. Description of Colquhoun-Moran "cavity lining" making use of double-shell construction embodying drainage cavity between inner gunite arch and primary lining of tunnel; test of gunite arch.

Water Supply Tunnels, Construction. High Speed Hard-Rock Tunneling for California Hydro-Electric Project. *Western Construction News*, vol. 12, no. 12, Dec. 1937, pp. 469–472. Driving of Pacific Gas & Electric Company's $9^1/_2$ × 11-ft heading, 1,060 ft long, in 75 shifts on job to eliminate old timber flume in central California; distribution of direct costs; record of electric power consumption; mucking and hauling; rotation of crews.

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INDEX OF PRODUCTS

Asphalt
  Socony-Vacuum Oil Co., Inc.
  Texas Co.

Barges, Steel
  Chicago Bridge & Iron Co.

Bars, Iron and Steel
  Carnegie-Illinois Steel Corp.

Bins, Storage
  Chicago Bridge & Iron Co.

Blasting Powder and Accessories
  Atlas Powder Co.
  E. I. du Pont de Nemours & Co., Inc.

Borings, Test
  Raymond Concrete Pile Co.

Caissons
  Raymond Concrete Pile Co.

Cement, High - Early - Strength Portland
  Lone Star Cement Corp.

Cement, Portland
  Lone Star Cement Corp.

Cold Mix
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Concrete Mixers
  Jaeger Machine Co.

Concrete Reinforcement
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  Cast Iron Pipe Research Assn.
  U. S. Pipe & Foundry Co.

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  Texas Co.

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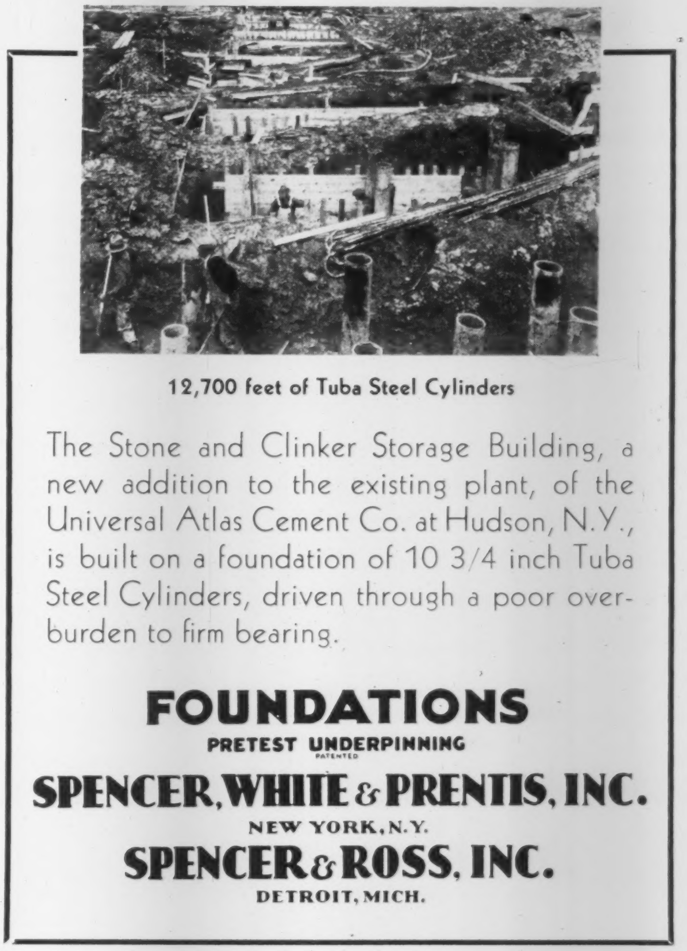
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WATER RESOURCES

UNDERGROUND SUPPLY, PENNSYLVANIA. Ground Water in Northeastern Pennsylvania, S. W. Lohman. *Pa. Topographic & Geologic Survey—Bul. W 4*, 1937, 312 pp., supp. map. Physical geography and geology of regions; ground-water geology and description of ground-water resources by counties. Bibliography.

UNITED STATES. Drainage Basin Problems and Programs, 1937 Revision. Washington, D.C., Nat. Resources Committee, Feb. 1938. 153 pp., maps, tables, 65 cents. Revision and extension of 1936 report bearing same title, including recommendations for improvement in national water policy, and 6-year program of construction and investigation work; progress in dealing with water problems; policies and projects of major federal interest and local interest.

WATER TREATMENT

ANALYSIS. Sanitary Analysis of Drinking Water, D. C. McCrady. *Eng. J.*, vol. 21, no. 5, May 1938, pp. 254–255. Outline of modern methods of chemical and bacteriological water analysis. Before Eng. Inst. Canada.

BACTERIOLOGY. Automatic Bacteriological Sampler, D. H. Matheson. *Am. Water Works Assn.—J.*, vol. 29, no. 12, Dec. 1937, pp. 1992–1994. Description of apparatus developed in filtration plant of Hamilton, Ontario, for taking water samples for bacteriological examination at regular intervals throughout 24 hours.

CALIFORNIA. California Water Treatment Practice, C. Wilson. *Western Construction News*, vol. 12, no. 10, Oct. 1937, pp. 379–380. Discussion of trends of California water-treatment practice, with special reference to surface water treatment, odor and taste control, increased reservoir control.

CHLORINATION. Chlorination of Cooling Waters, N. C. Estes. *Refiner*, vol. 17, no. 5, May 1938, pp. 191–197. Outline of effect of bacteria and algae in slime fouling; application of chlorine for slime control; fundamental factors which may not be overlooked in interests of complete and positive slime prevention.

CHLORINATION. Dosage of Chlorine in Ammonia-Chlorine Treatment of Water, M. L. Koshkin. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1761–1774. Report from Department of Experimental Hygiene of Second Medical Institute, Kharkov, U.S.S.R., on chemical methods of determining correct dosage of chlorine in water treatment; bactericidal action of chlorine in water; residual chlorine at various periods after chlorination; iodometric method for determining dose of chlorine for ammoniated water.

CINCINNATI, OHIO. Cincinnati's New Water Works, C. S. Timanus. *Am. City*, vol. 53, no. 4, Apr. 1938, pp. 69–73. Features of renovated 3,200-mgd water-treatment plant being completed at cost of $3,250,000; deficiencies to be corrected; penstock lines; chemical handling equipment; electrical system.

DAYTONA BEACH, FLA. New Water-Softening Plant at Daytona Beach, Florida, A. P. Black and R. G. Hicklin. *Am. City*, vol. 53, no. 4, Apr. 1938, pp. 61–64. Description of recently completed 4-mgd lime-soda water-softening plant; pumping equipment; salting of wells; chemical treatment; laboratory control.

NEUTRALIZATION. Die neuesten Erfahrungen ueber die Trinkwasserbehandlung durch Magnofilter, K. Schilling. *Chemische Fabrik*, vol. 10, nos. 49–50, Dec. 8, 1937, pp. 504–508. Latest experiences in treatment of drinking water by means of magno filter; notes on neutralization of cold water, design and operation of neutralizing filter, treatment of hot water, and iron and manganese removal from water; advantages of magno filter material.

OPERATION. Operating Kinks, A. R. Todd. *Am. Water Works Assn.—J.*, vol. 30, no. 1, Jan. 1938, pp. 112–120. Review of experience in operating water-treatment plants of Wheeling, W.Va., water works; low-water temperature results; chlorine tests; filter sand; electrolysis; bacteria and pH; laboratory work; mold spores; carbon; chemicals in water.

PITTSBURG, CALIF. Aeration and Chlorination in Novel Water Treatment, L. H. Cook. *Western Construction News*, vol. 13, no. 1, Jan. 1938, pp. 34–35. Successful treatment of mineral-spring type of well water at Pittsburg, Calif., to remove hydrogen sulfide and iron; settling basin permitting recovery of 95 per cent of backwash water from filters; layout of plant.

RESERVOIRS, ALGAE CONTROL. Sunshine and Alga Control, R. F. Goudey. *Eng. News-Rec.*, vol. 120, no. 16, Apr. 21, 1938, pp. 581–582. Method of saving up to 20 per cent anti-algae chemicals based on forecasting algae development from correlation with solar ultra-violet activity; relation between sun-spot activity and solar ultra-violet radiation.

RESERVOIRS, HYGIENE. Die gesundheitlichen Aufgaben beim Bau und Betrieb der Trinkwasser-Talsperren, F. Meyer. *Bauingenieur*, vol. 18, no. 47/48, Nov. 26, 1937, pp. 747–752. Review of sanitary problems in construction and operation of water supply reservoirs; review of German practice as to preparation of sites for drinking water reservoirs, prevention of pollution, and plants for treatment of stored water.

UNITED STATES. A.W.A. Meets in New Orleans. *Eng. News-Rec.*, vol. 120, no. 19, May 12, 1938, pp. 691–694. Proceedings of 1938 annual convention of American Water Works Association, including abstracts of papers and discussions on air-conditioning requirements; corrosion control and management practice; plant operation; Mexican water supplies; pipe studies, etc.

WATER WORKS ENGINEERING

BIRMINGHAM, ALA. Birmingham Industrial Water Supply, A. C. Decker. *Am. Water Works Assn.—J.*, vol. 30, no. 1, Jan. 1938, pp. 56–66. Construction of industrial water supply system for Birmingham, Ala., at estimated cost of $5,808,000, consisting of impounding dam to form reservoir more than 1,600 acres in area; 44 miles of supply and distribution mains ranging in size from 16 to 60 in., distribution reservoir, chemical adjustment plant, and service lines from 4 to 20 in. in diameter.

CROSS CONNECTIONS. Elimination of Cross Connections, F. R. King. *Domestic Eng.*, vol. 151, no. 5, May 1938, pp. 46–47 and 114–117. Installation, operation, and design factors for building water-supply systems and water appliances discussed for case of typical installation in multi-story building.

CURRENT PROBLEMS. Looking at Today's Problems, P. Hansen. *Eng. News-Rec.*, vol. 120, no. 16, Apr. 21, 1938, pp. 566–568. Review of recent American problems in water-treatment prevention of and water-borne disease; corrosion control; aids to distribution efficiency; statistical data on purification works placed in operation in 1937.

DISTRIBUTION SYSTEMS, DESIGN. Meeting Peak Demands, T. C. Forrest, Jr. *Eng. News-Rec.*, vol. 120, no. 16, Apr. 21, 1938, pp. 572–574. Outline of methods used in determining design of distribution system to supply maximum demand of 400 gal per day per capita, for Highland Park, Tex., serving population of 10,000; monthly water consumption and rainfall data; pipes and pumps; economical sizes of mains for various rates of flow; rates of pumpage as affected by storage for various daily consumption demands.

EMERGENCY OPERATION. Organization and Preparation of Water Works to Meet Major Catastrophes. *Am. Water Works Assn.—J.*, vol. 29, no. 11, Nov. 1937, pp. 1739–1760. Symposium on emergency operation of water works, presented at 1937 annual convention of American Water Works Association.

NOVA SCOTIA. Nova Scotia Water Supplies, R. D. McKay. *Am. Water Works Assn.—J.*, vol. 30, no. 1, Jan. 1938, pp. 152–159. Review of 43 water works of Nova Scotia; methods of supervision of operation of water works; features of typical water supplies system; problems of cross-connections.

RECONSTRUCTION. Revamping Water System, R. E. Lawrence. *Eng. News-Rec.*, vol. 120, no. 16, Apr. 21, 1938, pp. 594–596. Discussion of engineering construction, management, and financing; program of improvements now under way for rehabilitation of run-down Leavenworth, Kans., water-works system; intake works; filtration plant details.

RESERVOIRS, HYGIENE. Die gesundheitlichen Aufgaben beim Bau und Betrieb der Trinkwasser-Talsperren, F. Meyer. *Bauingenieur*, vol. 18, no. 47/48, Nov. 26, 1937, pp. 747–752. Review of sanitary problems in construction and operation of water supply reservoirs; review of German practice as to preparation of sites for drinking water reservoirs, prevention of pollution, and plants for treatment of stored water.

SALEM, ORE. New Water Supply System Completed for Salem from Santiam River, R. E. Koon. *Western Construction News*, vol. 12, no. 11, Nov. 1937, pp. 444–448. Design and construction of new $1,000,000 water-supply system of Salem, Ore., including infiltration-collection works on Stayton Island, chlorination plant, approximately 18 miles of concrete and steel pipe (mainly 36 in. in diameter), 10,000,000-gal covered concrete reservoir, and 100,000-gal elevated steel tank.

WATER WELLS, CONSTRUCTION. Wells and Water Supply, J. G. Gordon, Jr. *Eng. News-Rec.*, vol. 120, no. 16, Apr. 21, 1938, pp. 588–590. Review of current advances in well construction methods and their application to installations in sand and gravel formations; underreaming; gravel packing; cementing; recent installations illustrative of application of improved construction methods; wells at Houston, Tex.

WELLS, NEW YORK. Record of Wells in Nassau County, N.Y. *N. Y. State Dept. Conservation—Water Power and Control Commission—Bul. GW-5*, 1938, 140 pp., supp. map. Logs and descriptive notes on some 200 water wells in Nassau County, New York; index of wells by owners. Bibliography.

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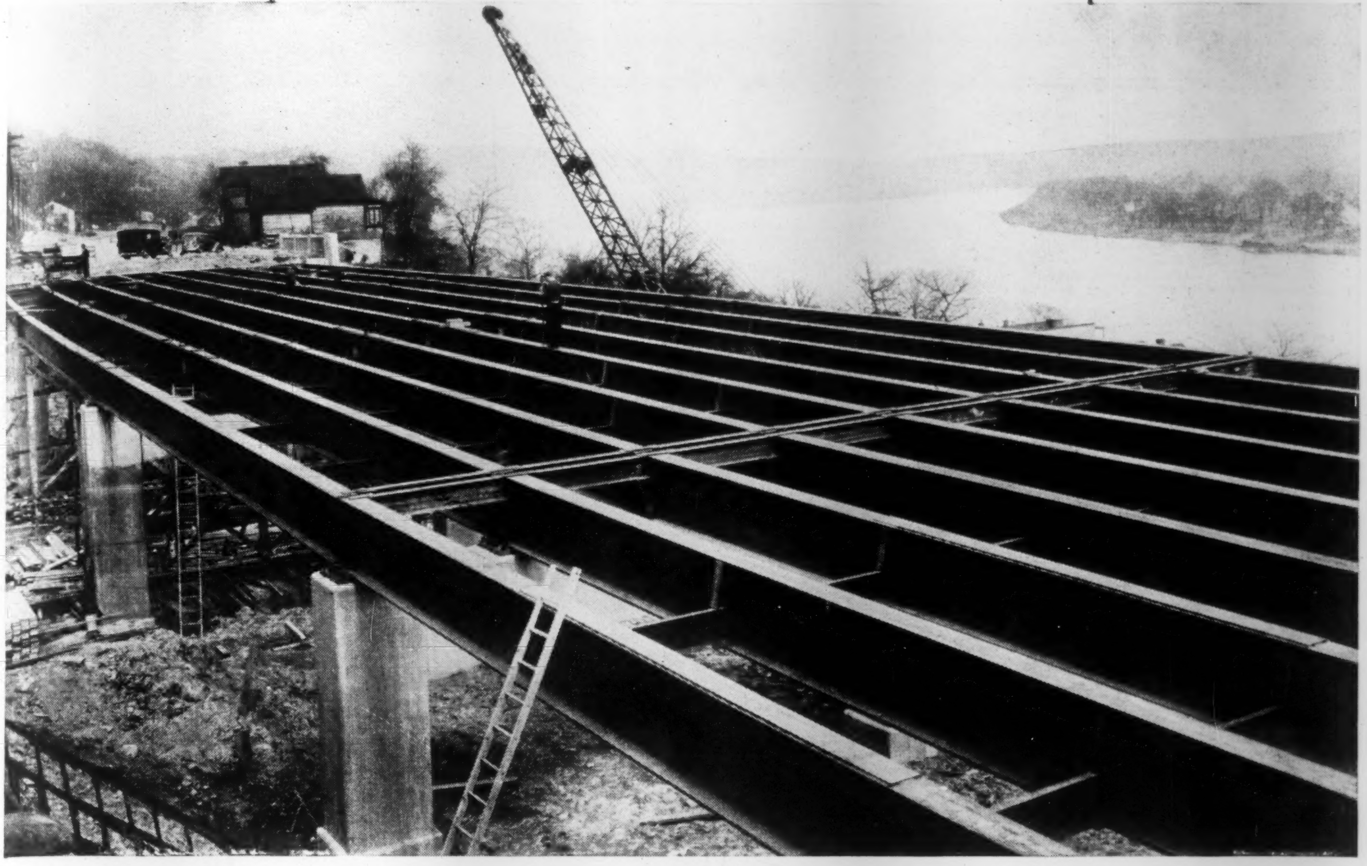

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Civil Engineer; M. Am. Soc. C.E.; 68; retired from practice, offers service as inspector; 40 years active experience. Southeastern territory preferred. C-381.

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Junior

Pump Engineer; Jun. Am. Soc. C.E.; 22; single; B.S.C.E., 1937; 1 year industrial experience, large paper mill; design of pump installations; drafting, structural, and piping; pump testing; trouble-shooting. Desires position in an industry in which pump installations are numerous and efficient operation desired. Now employed, but available on reasonable notice. C-375.

Civil Engineer; Jun. Am. Soc. C.E.; 23; B.S.C.E., Purdue University, 1937; experience, 8 months surveying and road construction; 10 months engineering department of railroad. Desires position with construction firm. Location United States or South America. Will travel anywhere. Now employed. Available on short notice. C-376.

Civil Engineer; Jun. Am. Soc. C.E.; 27; married; B.S.C.E., 1934; specializing in structures at present; 10 years varied experience; 4 years as structural and architectural draftsman, detailing, designing on tunnels, bridges, buildings, viaducts; 7 months engineering assistant, parkway, bridge, and drainage construction; 5½ years engineer, draftsman, cartographer, topographer, and statistician on traffic and market research. C-377.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.C.E., Manhattan College, 1936; M.S.C.E., Virginia Polytechnic Institute, 1938; teaching fellowship, V.P.I., 1937–1938; Phi Kappa Phi member; co-author of bulletin, "Sands of Virginia"; 9 months experience in design. Desires position in structural steel and concrete design or instructorship in civil engineering. Location immaterial. C-379.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; M.S. in C.E.; 1 year of experience in reinforced concrete detailing, highways, bridges. Immediate salary secondary to experience. Design and construction of buildings, bridges, dams, foundations preferred. Location immaterial. C-380.

Teaching

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate of Massachusetts Institute of Technology, B.S. and M.S. in C.E.; age 33; 10 years practical engineering experience. Desire position of assistant professor in civil engineering in Eastern college to teach theory of structures, mechanics, reinforced concrete design, hydraulics, water power engineering, and surveying. C-387.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 108 of the Year Book for 1938. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

(A) Modern Spanish-English and English-Spanish Technical and Engineering Dictionary. By R. L. Guinle. New York, E. P. Dutton & Co., 1938. 311 pp., 10 × 6 in., cloth, $4.

There are relatively few dictionaries of Spanish and English technical terms, and still fewer that have been revised recently, so this is a useful addition to the field. The present volume is well-printed, of convenient size, the work of an English engineer with long experience in South America. The vocabulary covers the terms used in civil, mechanical, and electrical engineering.

Principles of Engineering Economy, rev. ed. By E. L. Grant. New York, Ronald Press Co., 1938. 431 pp., diagrs., charts, tables, 8 × 6 in., cloth, $3.75.

Demonstration of a practical technique providing an engineering basis for making economic decisions is the purpose of this book. Interest, valuation, and rate of return calculations are explained. The making of estimates for new enterprises, replacement problems, and the planning of future developments are discussed. Appendices contain notes on cost estimating, interest tables, and a list of selected references.

Public Works Engineers' Yearbook, 1938. Chicago, American Public Works Association (1313 East 60th Street), 1938. 459 pp., tables, diagrs., charts, 9 × 6 in., cloth, $3.30.

This volume, which includes the proceedings of the Public Works Congress, October 4–6, 1937, presents a comprehensive review of developments in the field of public works during the past year. There are 20 articles by authorities on matters pertaining to the administration, financing, and engineering of public works. Personnel problems, planning in small cities, methods of refuse collection, and municipal utility rates are among the other subjects considered.

Reinforced Concrete Bridge Design, 2 ed. new and enlarged. By C. S. Chettoe and H. C. Adams, with a foreword by Sir H. Maybury. London, Chapman & Hall, 1938. 412 pp., illus., diagrs., charts, tables, 10 × 6 in., 42 s.

Detailed information on the design of reinforced concrete bridges is given in this volume. There are four introductory chapters on structural theory concrete, design essentials, and live load on highway bridges. The next five chapters contain practical design data with all details. The concluding chapters cover such allied subjects as piling, excavation, curves, expansion, bridge strengthening and widening, esthetics of design, and location problems.

Field Engineering, a Handbook of the Theory and Practice of Railway Surveying, Location, and Construction. Vol. 1, Text, 366 pp.; Vol. 2, Tables, 403 pp., bound in one volume. By W. H. Searles. 21 ed., rev. and enl. by H. C. Ives. New York, John Wiley & Sons, 1936. Diagrs., charts, tables, leather, 7 × 4 in., $4.

The principal changes in the text of this edition are that the chapter on "String Lining Curves" is by Prof. Philip Kissam, and that the chapter on "Highway Curves" has been entirely rewritten. The volume of tables has been enlarged by the addition of the following three new tables: radii, deflections, and chords for arc definition of degree of curve; even foot radii—deflections and chords; coefficient K for central angles of certain curves. The tables relating to split switches have been replaced by new ones based on material supplied by the American Railway Engineering Association. Minor changes and additions have been made throughout the work.

Simplified Engineering for Architects and Builders. By H. Parker. New York, John Wiley & Sons, 1938. 214 pp., charts, diagrs., tables, 8 × 5 in., leather, $2.75.

The intention of this book is to assist the inexperienced architect or builder in selecting the proper structural member for given conditions. Following a section on the fundamentals of mechanics come chapters on timber, steel, and reinforced concrete construction and on roof trusses, explaining the design and use of the main types of structural members in each class by means of descriptive problems. Necessary tables are included.

Standard Plumbing Details for Architects, Engineers, Contractors, Plumbers, and Students. By L. J. Day. New York, John Wiley & Sons, 1938. 119 pp., diagrs., charts, tables, 12 × 9 in., cloth, $6.

A collection of 119 plates intended to show the connections required in plumbing installation and how they fit together, so that proper spaces may be provided in a building. The drawings, which are drawn to scale, cover fixtures, equipment, installations, and layouts, for all usual requirements, and conform to general codes.

Steels for the User. By R. T. Rolfe. New York, Chemical Publishing Co., 1938. 280 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $8.50.

Carbon steels, with particular reference to bright and free-cutting steels, are the subject of this expansion of material which appeared in a series of articles in *Iron and Steel Industry*. Composition, heat treatment, case hardening, mechanical testing, and selection of steels are discussed, with a special chapter on the use of steels at elevated temperatures.

Trane Air Conditioning Manual, 2 ed. La Crosse (Wis.), The Trane Co., 1938. 333 pp., illus., diagrs., charts, tables, 11 × 8 in., cloth, $5.

Primarily concerned with the application of the fundamental facts of engineering to the design of air-conditioning systems, this publication touches on all phases of the field. Heat and its transmission, physical comfort, air properties and supply, psychrometry, refrigeration and ventilation processes, and the functions of water in air conditioning are all considered in this comprehensive treatment of the subject.

HOW TO MOVE DIRT FASTER

Model L tractor and 7-yd. Continental scraper widening and straightening a county road.

Model S-O tractor and 7-yd. Continental scraper repairing a bad break in a flood-damaged irrigation canal. Ability to end dump is doubly worthwhile in these tight quarters. The S-O shifts on the go like a truck—no stops for gear changes.

Put Allis-Chalmers tractors and Continental scrapers on your job. Watch the scrapers load fast and high even in wet, sticky clay or shale. Use them to cut driveways and build approaches. Place material where you want it by end dumping as you would with a truck—backfill on slopes, against bridge abutments, over culverts, or spread in windrows on the fill. Gain profitable extra trips every shift because A-C tractors have the reserve power to hog in capacity loads quickly . . . more and higher speeds to cut hauling time . . . ability to get about in close quarters with ease.

Ask your Allis-Chalmers dealer how this fast-moving combination can move dirt faster on your jobs . . . .

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

China. Chinese Bridges, H. Fugl-Meyer. Shanghai, Hong Kong, and Singapore, Kelley and Walsh, Ltd., 1937. 138 pp., illus., diagrs., $5. (also K. Paul, London, 9s). Descriptive information concerning old Chinese bridges, including stone and wooden trusses, stone and brick arches, wooden cantilevers, and rope and chain suspension bridges; historical notes, superstitions, and results of some bending tests on stone beams included. Eng. Soc. Lib., N.Y.

Concrete. Einfluss durchlaufender Quertraeger bei mehrwandigen Eisenbetonbalkenbruecken, E. Hennigs. *Beton u Eisen*, vol. 36, nos. 20 and 21, Oct. 20, 1937, pp. 323–327, and Nov. 5, pp. 346–351. Influence of cross beams in multiple walled reinforced concrete bridges; theoretical mathematical analysis of typical bridge construction in which floor system consists of heavy outer and lighter inner beams connected by cross ties; practical method for determining redistribution of stresses resulting from action of cross beams.

Low-Level. Low-Level Bridges, Their Advantages for Tropical Conditions, S. McConnel. *Civ. Eng.* (London), vol. 32, no. 376, Oct. 1937, pp. 365–366. Principles of design of low-level bridges for flashy tropical streams; such bridges are expected to be submerged for short periods of heavy rainfall and are designed to stand impact of floating logs and similar objects.

Steel, Strengthening. Reconditioning and Reinforcing Bridges by Arc Welding, S. G. P. de Lange and H. J. B. Evans. *Civ. Eng.* (London), vol. 32, no. 375, Sept. 1937, pp. 331–333. Review of modern practice of strengthening steel bridges by arc welding methods; typical weld details.

Steel Truss, Failure. Collapse of Welded Bridge. *Ry. Gaz.*, vol. 68, no. 20, May 20, 1938, pp. 984–985. Road and tramway bridge over Albert Canal at Hasselt, Belgium, which collapsed within period of 6 min. Similar description previously indexed from *Eng. News-Rec.*, May 5, 1938.

Steel Truss, Tanganyika. Kilosa Bridge, C. Y. Stevenson. *Civ. Eng.* (London), vol. 32, no. 377, Nov. 1937, pp. 396–399. Design and construction of steel-truss and plate-girder highway bridge in Eastern Province of Tanganyika Territory having total length of 313 ft, main span 120 ft long; labor and construction difficulties; construction of cofferdams and sinking of caissons.

BUILDINGS

Air Conditioning, Hospitals. Klimatechnik und Reilbehandlung im Krankenhaus, H. Wolfer. *VDI Zeit*, vol. 82, no. 21, May 21, 1938, pp. 603–609. Air conditioning and cure treatment in throat, nose, and ear clinic of Katherinan Hospital, Stuttgart; notes on installation and control equipment; results obtained.

Auditoriums, Acoustics. Auditorium Acoustics and Reverberation, A. Th. Van Urk. *Philips Tech. Rev.*, vol. 3, no. 3, Mar. 1938, pp. 65–73. Phenomenon of reflection, called reverberation, is studied by means of measurements and calculations; this study leads finally to several simple conditions which must be fulfilled if auditorium is to have satisfactory acoustics.

Motion Picture Theaters, Italy. Neuere Filmtheatergalerien Mittelitaliens unter Vermeidung blickstoerender Zwischenstuetzen, G. Neumann. *Beton u Eisen*, vol. 37, no. 2, Jan. 20, 1938, pp. 25–29. Structural details of recently completed cinema theaters in Florence, seating capacity 3,000, and in Siena, Italy; designs are characterized by absence of intermediate columns which might obstruct view.

Observatories, Domes. Dome for World's Largest Telescope Presents Unusual Insulation Problem, C. Turner. *Heating, Piping & Air Conditioning*, vol. 10, no. 6, June 1938, pp. 369–371. How dome at Mt. Palomar (Calif.) astrophysical observatory is being insulated; brief discussion of some of its features; uniform temperature level during each 24-hour period throughout year essential in order to prevent movement of telescope supporting structure and displacement of mirrors.

Stadiums, Indoors. Le stade Pierre-de-Coubertin. *Travaux*, vol. 22, no. 65, May 1938, pp. 199–203. Description of recently completed Pierre-de-Coubertin indoor stadium at Porte de Saint-Cloud, Paris, France, including main athletic hall seating 5,000, six indoor tennis courts, auditorium, club accommodations, etc.

Ventilation, Show Windows. Ventilating Store Windows to Prevent Condensation, H. A. Stevenson. *Heating & Vent.*, vol. 35, no. 6, June 1938, pp. 27–28. Results of experiments conducted by British chain store to determine best methods to overcome condensation of moisture on store windows. Before Brit. Assn. Advancement Science.

Welded Steel Structures. Structural Engineers Swinging to Welding. *Welding Engr.*, vol. 23, no. 5, May 1938, pp. 22–26. Short notes and various illustrations showing new welded buildings in state of erection or completed.

Williamsburg Houses Project, Heating. Heating 5,688-Room Housing Project. *Heating & Vent.*, vol. 35, no. 6, June 1938, pp. 23–26 and 78. Features of heating installation at Williamsburg Houses Project, Brooklyn, N.Y.; 10 separate heating plants supply steam and hot water for 20 buildings, each plant serving two buildings.

Wind Effects. Wind Action on Buildings, R. Fleming. *Engineering*, vol. 145, no. 3765, Mar. 11, 1938, pp. 280–282. Review of researches on this subject.

CONCRETE

Construction. Cement in Constructional Design, P. G. Bowie. *Roy. Soc. Arts—J.*, vol. 86, no. 4460, May 13, 1938, pp. 636–647 (discussion), 647–652. Review of developments in use of cement in mortar and making of concrete; summary of some of building materials available, and outline of position that concrete holds among them.

Construction Costs. Improved Method of Design Reduces Cost of Concrete Buildings. *Concrete*, vol. 46, no. 6, June 1938, pp. 3–4. Lower form costs, shallow floor construction, longer spans, and fewer columns are major features of new type.

Construction—Wood Reinforcement. Brueckenwiderlager und-pfeiler aus Holzbeton, M. I. Ewdokimow-Rokotovsky. *Beton u Eisen*, vol. 36, no. 20, Oct. 20, 1937, pp. 321–323. Bridge abutments and piers of concrete reinforced with wood for river crossing in Siberia; piers were 42 ft high and 3.2 by 1.8 ft in cross-section, reinforced with four posts 8.0 in. in diameter tied by twenty 0.8-in. stirrups; laboratory tests of bond between wood and concrete; deterioration of wood reinforcements due to fermentation of sap.

Dams, Construction. Making Concrete for Conchas Dam. *Eng. News-Rec.*, vol. 120, no. 23, June 9, 1938, pp. 811–812. Description of concrete-mixing and concrete-placing equipment used in construction of Conchas concrete-gravity dam in New Mexico, including 2-mile aerial tramway and two-tower cableway.

Design. Working Stresses for Rational Design of Concrete Structures, J. Marin. *J. Applied Physics*, vol. 9, no. 1, Jan. 1938, pp 49–53. New theory of failure for materials subjected to combined state of stress; theory is developed for brittle materials, such as concrete, in which compressive and tensile strengths are of different magnitudes; it is semi-empirical theory which has some experimental support; based on it working stresses are defined for various loading conditions.

Floors. Laying Floors, B. Nordberg. *Rock Products*, vol. 41, no. 6, June 1938, pp. 79–80. Use of concrete filler tile in laying floors at Vanderbilt University Hospital, Nashville, Tenn., resulted in construction level to within $^1/_8$ in.

Floors. New Floor Construction with Precast Concrete Plank. *Concrete*, vol. 46, no. 6, June 1938, p. 8. Description of new concrete pre-cast plank which has been used successfully in flooring more than 53 buildings in and about New York City; nature of unit; placement; official tests.

Prefabricated. To Erect Pre-cast Concrete Home in Four Hours. *Concrete*, vol. 46, no. 6, June 1938, p. 5. Mid-West Construction Corp., Chicago, plans to demonstrate practical utility of novel method; casting and finishing of slab units.

Reservoirs, Lining. Relining Elevated Storage Reservoir with Gunite, R. W. Esty. *New England Water Works Assn.—J.*, vol. 52, no. 1, Mar. 1938, pp. 30–57. History of Wills Hill water-distribution reservoir at Danvers, Mass., 125 ft in diameter, 700,000-gal capacity; details of gunite relining operations; costs.

CITY AND REGIONAL PLANNING

Germany. Einfluss der Technik auf Gestaltung und Ausbau der Stadt Stuttgart, K. Stroelin. *VDI Zeit*, vol. 82, no. 21, May 21, 1938, pp. 593–597. Influence of engineering on development of city of Stuttgart; history of city development and discussion of important municipal systems; building codes.

DAMS

Bonneville Dam, Canal Locks. Erection Methods on World's Record Lock Gates at Bonneville Dam, R. S. Brabrook. *Western Construction News*, vol. 13, no. 4, Apr. 1938, pp. 136–138. Fabrication procedure used in installing world-record gates (102 ft high, weighing over 600 tons) at lower end of ship lock, at Bonneville navigation and power project; handling sections of steel during erection.

Concrete Gravity, California. Bids Called for Shasta Dam–Central Valley Project. *Western Construction News*, vol. 13, no. 4, Apr. 1938, pp. 129–132. Outline of plan for construction of central California concrete gravity dam, 560 ft maximum height, 3,500 ft long, which will contain about 5,600,000 cu yd of concrete.

Concrete Gravity, California. Review of Shasta Dam Plans. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 175–182, 4 supp. plates. Plans for construction of Shasta concrete gravity dam, maximum height 560 ft, length 3,500 ft; description of site and conditions affecting construction operations; specifications; stream flow and floods; geology at dam site; aggregate supply; contractor's camp sites; bidding schedule; program for construction progress; minimum wage scale established in specifications.

Concrete Gravity, New Mexico. Dam Building on Difficult Rock. *Eng. News-Rec.*, vol. 120, no. 23, June 9, 1938, pp. 807–811. Description of Conchas Dam over South Canadian River in New Mexico, now in course of construction—maximum height 235 ft, crest length 1,250 ft; cofferdam layout for river section, shaft sinking plan for monolith; construction plan; shale-abutment difficulties; underpinning caprock.

Concrete Gravity, Washington. Grand Coulee Dam. *Engineer*, vol. 165, nos. 4282, 4283, and 4284, Feb. 4, 1938, pp. 126–128, and 138; Feb. 11, pp. 154–156, and 166; and Feb. 18, pp. 182–184. Detailed illustrated description. Similar descriptions indexed in *Engineering Index* 1936, p. 287, and *Engineering Index* 1937, p. 300, from various sources.

Construction, New Mexico. Contractor's Plant and Program for Concrete Placing at

(*Continued on page 18*)

Delay takes a holiday when Bethlehem handles the job

Bethlehem's steel construction division is a fully-coordinated part of an organization making practically all steel products used in building. As such, it represents a unique set-up for swift action in building with steel. It can draw at will upon plate and structural mills, foundries and a large bolt and nut plant for all materials from major structural members to fastenings. Fabricating shops and erection equipment are located at strategic points throughout the country. Because of this unusual integration, Bethlehem, the largest steel construction company in the world, can be depended upon to complete projects of any size with maximum speed and efficiency.

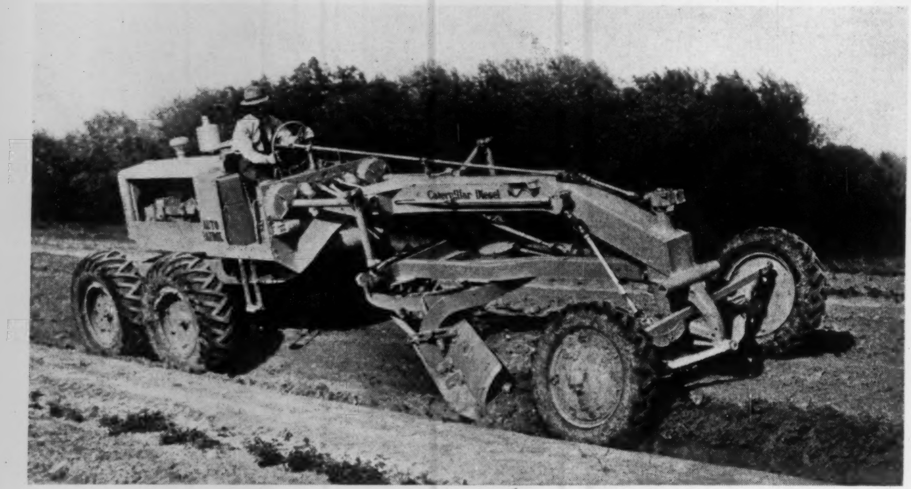
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

New "Caterpillar" Diesel Auto Patrol



A HEAVY-DUTY, self propelled road grader, the Diesel No. 12 Auto Patrol, has been anounced by Caterpillar Tractor Co.

The new machine has a wide range of useful blade positions. In addition to high or low bank cutting positions, the blade can be turned completely around on the full revolving circle, so that it may readily be positioned for working in reverse gear. With the blade mounted in the center position on the blade beams, the new Auto Patrol permits a correct ditching position on either side, with the toe of the 12-foot blade directly behind the front ditch wheel, and ample clearance to prevent clogging.

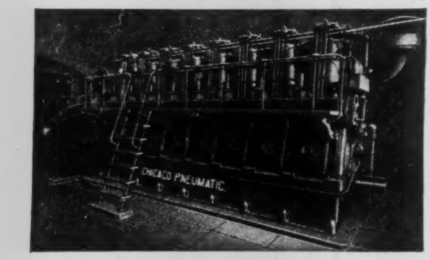
A six-cylinder "Caterpillar" Dieselengine delivers 66 brake hp, and is mounted over the driving axle to best utilize its weight in preventing wheel slippage. A gasoline starting engine insures easy starting regardless of atmospheric temperatures.

The transmission offers six forward speeds and two reverse. A low speed of 1.8 mph provides maximum pull for the heaviest jobs, and slow speed for fine grading. The second speed of 2.8 mph, with four higher speeds of 4.3, 6.8, 9.6, and 15.2 mph give ample speed range. Reverse speeds are 2.4 and 3.8 mph.

The Diesel No. 12 Auto Patrol is equipped with two speed mechanical power controls. Shift of a lever in the gear box gives faster control for the longer blade movements on coarse work. For close finishing work, requiring extreme accuracy in blade settings, the slower control is quickly available. The new Auto Patrol has tandem drive and leaning front wheels as standard equipment.

The C-P Diesels

A MODERN DIESEL engine, ranging in size from 300 to 800 hp, is announced [in Bulletin 769] by the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N.Y.



These engines, Type RHB-100, are four cycle, solid-injection power plants designed especially for heavy-duty, continuous, or automatic service.

The features reported for these engines are rugged base construction, accessible frame parts, effective balancing, low fuel consumption, and sensitive control at all operating speeds.

New Universal Crusher

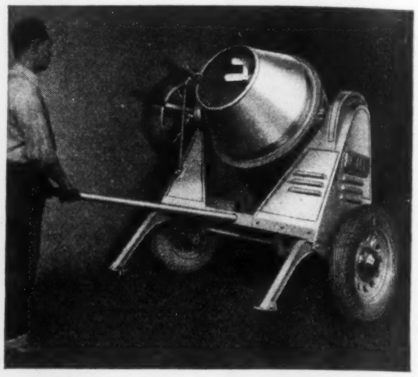
BECAUSE THE Universal No. 1016 "Streamlined" Jaw Crusher, introduced recently, has met with wide favor, the Universal Crusher Company, Cedar Rapids, Ia., has introduced the larger No. 2436 "Streamlined" Crusher with 24 in. × 36 in. feed opening.

Like the No. 1016, this crusher has a one-piece alloy steel base with smooth exterior, reinforced on the inside. This construction provides approximately 20% saving in weight which effects savings in freight and greater portability.

The entire base is flush at the bottom, providing a firm footing, the bolt holes being on the same centers as ordinary models to allow for ready interchangeability. Other features include the six heavy duty roller bearings, two on the Pitman and two on each side; quick acting product-size adjustment, and wide feed opening. All major parts are made to be interchangeable with regular models of Universal 24 in. × 36 in. Crushers.

New Jaeger Mixer

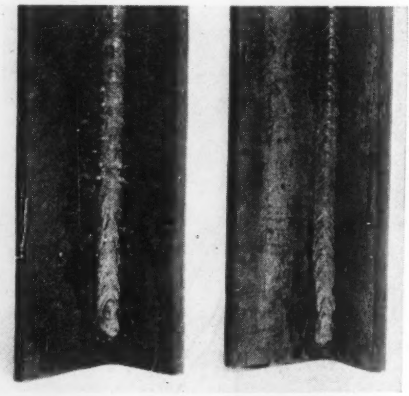
LATEST ADDITION to the Jaeger line of mixers is the $3^{1}/_{2}$S "Speedster," a tilting type powered with an air-cooled engine. The $2^{1}/_{2}$ hp plant is housed between drum and axle, making a very compact mixing unit.



Machine is mounted on spring shock absorbers, Timken bearings and pneumatic tires, with detachable towing pole for fast trailing and easy maneuvering. Standard Jaeger construction is used throughout. A bulletin describing this and other end discharge type mixers may be obtained from The Jaeger Machine Company, Columbus, Ohio.

New Compound Aids Cleaning After Welding

A NEW COMPOUND, which is said to reduce cleaning time after welding by 20 to 60%, is announced by The Lincoln Electric Company, Cleveland, Ohio. By reducing the tendency of spatter to adhere tightly, "Spatter Film" makes fabrication by arc welding still more economical, particularly in work where painting and finishing are essential.

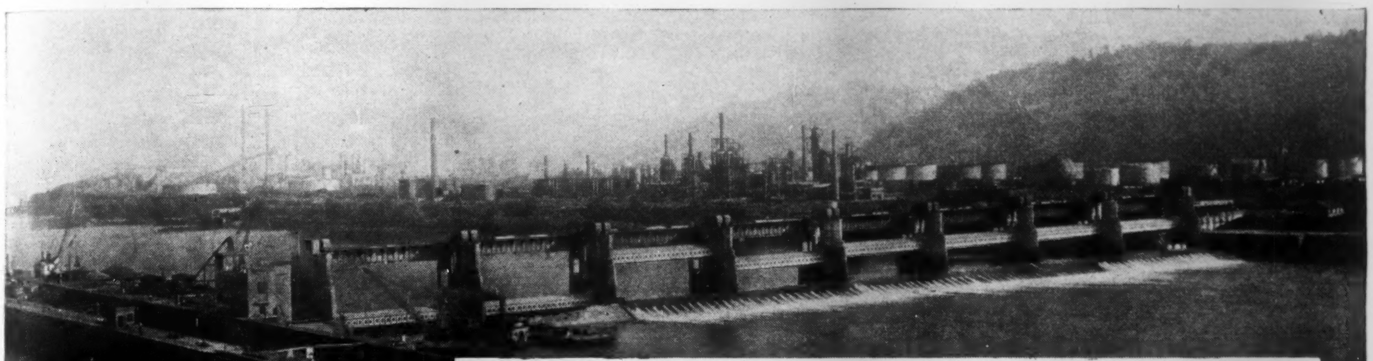


"Spatter Film" is soluble in water, is non-inflammable and contains no free alkali to injure the hands nor harm paint; is easy to apply by means of an ordinary paint brush. A gallon of "Spatter Film" will cover approximately 50,000 sq in. of surface.

"Spatter Film" is sold in quart, gallon and 5-gallon cans, or 55-gallon drums.

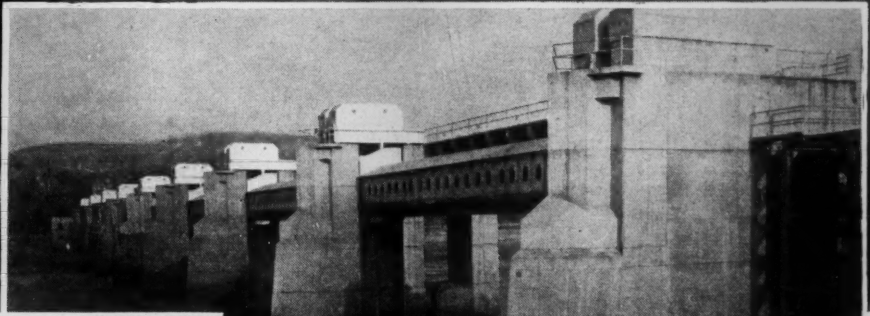
NEW EMSWORTH DAM

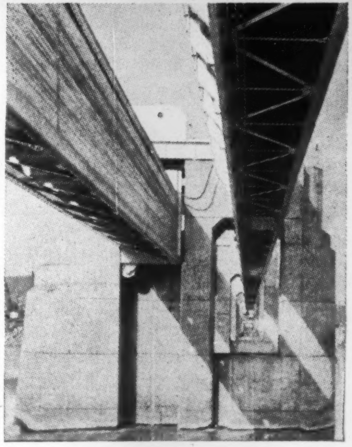
improves navigation for 24 Miles



DOWNSTREAM VIEW *of the main-channel dam. Neville Island, in the background, divides the Ohio River into two channels. The back-channel dam, not seen, is similar in construction.*

Emsworth Dam was constructed under the supervision of the U. S. Engineers Office, Pittsburgh, Pa., Lt. Col. W. E. R. Covell, district engineer.





MAIN-CHANNEL DAM *viewed from Neville Island. Vertical lift gates are 109 ft. 4 in. out to out of end rollers, 11 ft. 10 in. wide, 12 ft. 10⅜ in. deep at crest-line and weigh 115 tons each. The Sidney Gate, installed in the back channel only, measures 101 ft. 11½ in. out to out end trunnions, 13 ft. 6in. in width with curved skin-plate face of 12 ft. 2in.*

• • •

VERTICAL LIFT GATE *in raised position at the left, machinery housing atop the pier and underside view of service bridge at the right.*

At Emsworth, Pa., on the Ohio, six miles below the confluence of the Allegheny and Monongahela Rivers, a new movable crest dam now replaces the old fixed type dam. This improvement raises the pool level sufficiently to open up a clear navigation reach of some 24 miles, and eliminates No. 1 Dams on both the Allegheny and Monongahela Rivers. The advantage to the eleven million tons of water-borne traffic that plies the river is obvious.

Neville Island, at this point, breaks the Ohio River into two channels requiring the construction of two dams — the one-thousand-foot main-channel dam consisting of 8 box section vertical lift gates and a 48-ft. fixed weir adjacent to the lock chamber, and a 750-ft. back-channel dam of similar construction but consisting of only 5 box section gates plus one of new design known as the Sidney Gate. The box type gates are designed for submergence. The Sidney Gate is non-submersible. It combines features of the Tainter and vertical lift types—it tilts to partial opening and then lifts to any height required.

Under contract to American Bridge Company was the entire gate installation, complete with service bridges, emergency bulkheads and dam parts, operating machinery and housings, electrical equipment and timber seals. The new dam is founded on Carnegie-Illinois H Piles. American Bridge, with ample resources and experience, is prepared to meet any requirement of specialized steel construction.

AMERICAN BRIDGE COMPANY

General Offices, Frick Building, Pittsburgh, Pa.

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* • United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

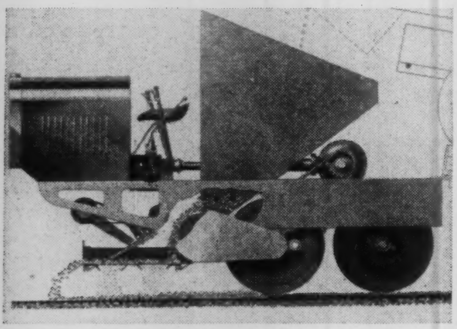
Poloroid Lighting

A RADICAL DEPARTURE in lighting has been announced by The Polarizing Instrument Co., 8 West 40th St., New York, N.Y. The first application of Polaroid to a lighting fixture is the Polaroid Desk Lamp.

This new lamp is reported to provide glare-free illumination for all kinds of work. The Polaroid element traps at the source the specular light rays, those which produce "mirror" reflections, and lets through the diffuse light. This eliminates reflected glare, the common cause of eye strain and fatigue, and, according to the manufacturer, materially improves vision on color or black and white subjects. Other types of fixtures are in process of development. A folder describing the desk lamp is available.

Road Material Spreader

A UNIQUE ROAD surfacing material spreader of new design for seal coating and spreading all types of stabilized road materials has been introduced by the Universal Crusher Co. of Cedar Rapids, Iowa.

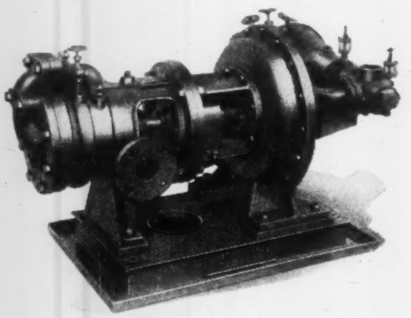


Known as the Universal Spreaderoller, this new machine segregates the aggregates into coarse material, medium sized material, and fines, depositing them in that order on a freshly sprayed bituminous surface and rolling them smooth in one operation and with one machine. The Spreaderoller consists of a chassis mounted on three rollers, the third of which is at the back of the machine directly behind the inside edges of the two forward rollers. The two forward rollers are driven and the machine is steered by braking either right or left driven roller. Mounted on the chassis are an industrial power unit and a hopper with mechanical distributor which feeds the aggregates to a shaker screen. A portable ramp is towed by the Spreaderoller which permits trucks to back up to and back-dump into the hopper.

The manufacturer states that the Spreaderoller meets all the requirements of a 10 ton roller and can be used for that purpose, as well as for spreading base coarse materials and all types of topping materials for stabilized roads. It has a low fuel consumption, is easily controlled from the operator's platform, and can be run in either direction. Approximately $^3/_4$ to 1 mile of highway 10 ft wide can be surfaced per hour, spreading from 15 to 25 lbs or more of material per sq yd.

New Turbine-Driven Pump

INGERSOLL-RAND announces a unique new turbine-driven pump featuring a compact construction that combines both turbine and pump as one unit on a common shaft. This pump, known as the "class TRV," is built in single-stage sizes for capacities from 5 to 1,000 gal per min against heads as high as 220 ft and in two-stage sizes for capacities to 275 gal per min and heads up to 550 ft.



It is reported that the unit assembly of pump and turbine makes possible a substantial reduction over ordinary turbine-driven pump weights and sizes. A 15 hp single-stage unit is about 32 in. long and other sizes are proportionately small. No special foundation is required and units are available for operation in any position. Additional information on these pumps is given in bulletin 2390, Ingersoll-Rand Co., 11 Broadway, New York, N.Y.

Kem Metal Paints

AN ADVANCEMENT in metal protective paints is reported by the Sherwin-Williams Co., of Cleveland. The products announced are S-W Kem-Metal Protective Paints and include Kem-Kromik Metal Primer, Kem-Elastic Metal Protective Paints, and Kem Red Lead (primer).

The distinguishing feature of these new products is said to be their chemically evolved (synthetic) S-W Kem Liquid. The advantages demonstrated under all standard tests by the paints utilizing this Kem Liquid are reported as follows:

1. More complete exclusion of water and gases from the metal protected.
2. A definitely greater durability.

The inhibitive value of the balanced lead chromate formulation of Kromik Metal Primer has been retained in Kem-Kromik. Kem Red Lead is offered as a superior red lead primer, and S-W G & G Primer is provided for the priming of galvanized iron and other zinc coated metals. Kem-Elastic is recommended as the finish coat over each of these primers.

Arc Welding Manual

TO COVER the new developments in arc welding, rods, machines, and technique, a 340-page manual has been brought out by Hobart Brothers Co., Troy, O. Bound in red Fabricoid, with 320 illustrations, "Arc Welding and How to Use It" is priced at $1.50 per copy in the United States and $2.00 in Canada and foreign countries.

Literature Available

AGITATORS AND MIXERS—The features of Rex Moto-Mixers and Moto-Agitators with their uses, construction details, and specifications, are covered in the booklet, "Payloads for '38," Chain Belt Co., Milwaukee, Wis.

COPPER-BEARING STEEL—Tests of the rust resistance of Beth-Cu-Loy Sheets are given in a recent folder. Bethlehem Steel Co., Bethlehem, Pa.

EARTH MOVERS—Earth moving in all parts of the world and under all types of climatic and soil conditions is illustrated and explained in a new booklet. Caterpillar Tractor Co., Peoria, Ill.

ELECTRODE—A 12-page booklet describes a new electrode called the Page Hi-Tensile G, recommended for flat and positioned fillet and general flat welding. Page Steel and Wire Division of American Chain & Cable Co., Monessen, Pa.

FLOW CONTROLLERS—The Simplex Type S, Rate of Flow Controllers for vertical effluent lines are covered in Bulletin 54. Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia, Pa.

HIGHWAYS—"Good, Low-Cost Roads," is a booklet published to promote a better understanding of road building among tax-payers, particularly those in farming communities. It will be of interest to civil engineers. Tractor Division, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

RECORDING AND CONTROL EQUIPMENT—Bulletin 140 illustrates Southwark's complete line of stress-strain recorders and extensometers. Baldwin-Southwark Corp., Paschall Post Office, Philadelphia, Pa.

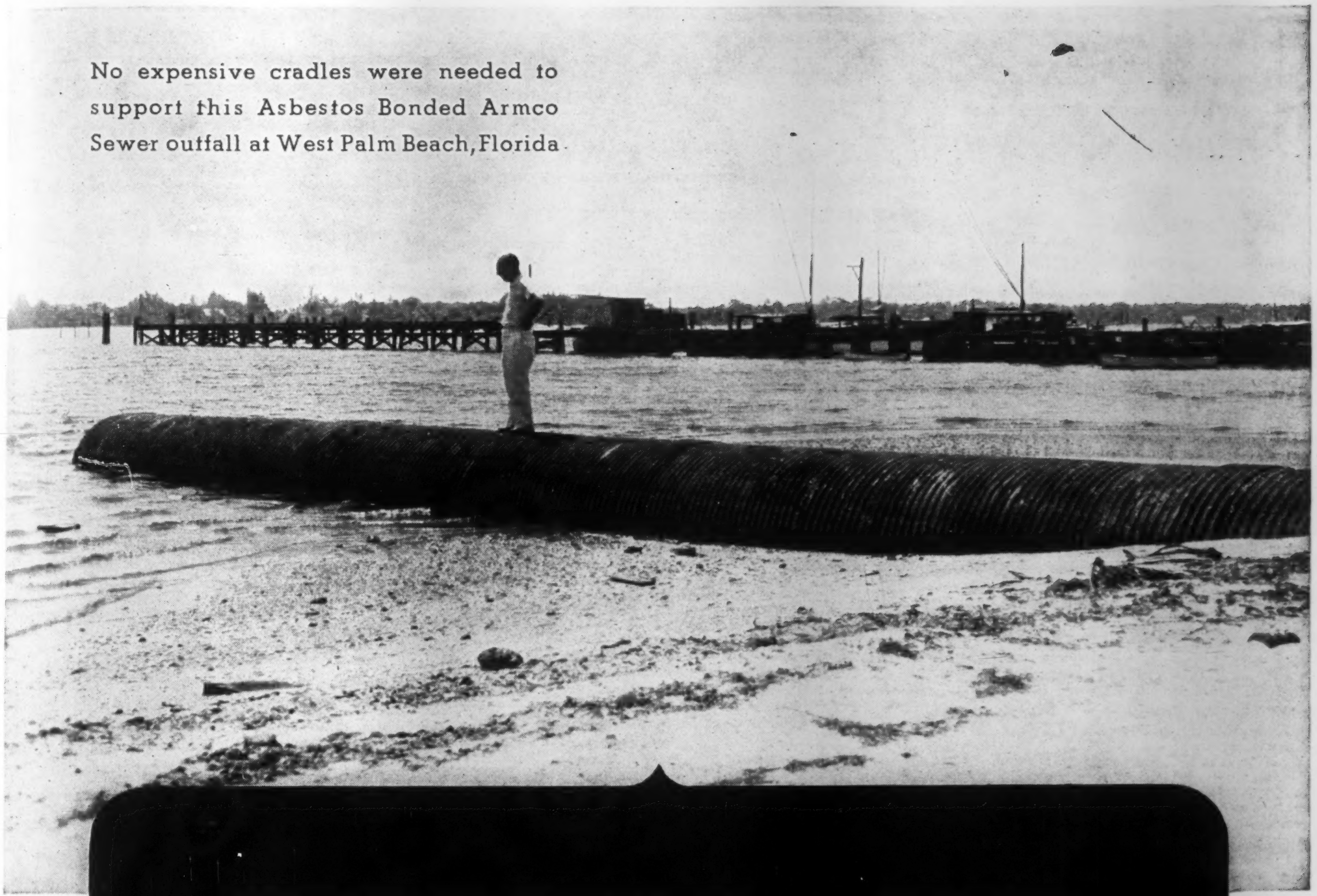
ROADS—CANALS—A handbook, entitled, "Roads, Canals and Embankments," has been published by Caterpillar Tractor Co., Peoria, Ill. Its 182 pages of 6 by 9 in. include comprehensive chapters on road construction; road improvement; paving and road surfacing; road maintenance; building canals with blade graders, with elevating graders; canal maintenance; embankments and terracing for soil erosion control. It is priced at 50¢ per copy, postpaid.

SEWAGE PURIFICATION—In a book of 124 pages, Guggenheim Brothers, 120 Broadway, New York, N.Y., present the reports of three consulting engineering firms on the operation of the Bio-Chemical Sewage Purification plant at New Britain, Conn. These reports cover the soundness and general applicability of the process. The book is entitled, "The Bio-Chemical Process—Purification of Sewage and Industrial Wastes."

STEEL—DYN-EL, a new high-strength flat-rolled steel with unusual resistance to fatigue, impact, and corrosion, is thoroughly described in a 46-page book, entitled, "A. W. Presents DYN-EL." Alan Wood Steel Co., Conshohocken, Pa.

WAGON SCRAPER—Bulletin 109 covers the entire line of wagon scrapers in 4, 5, 7, and 10 yd sizes; both low pressure tire and crawler mounted. Continental Roll & Steel Foundry Co., East Chicago, Ind.

WOOD PIPE HANDBOOK—contains 265 pages and 150 illustrations, ranges from section on hydraulics to a description of the manufacture and application of wood pipe. National Tank & Pipe Co., Kenton, Station, Portland, Ore.



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(Continued from page 12)

Conchas Dam, L. T. Grider. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 192–194. Description of construction plant for New Mexico flood-control project, including 235-ft concrete main dam, earth and rock-fill wing dams on each side, supplemental earth dikes and emergency spillway; equipment includes aggregate plant with capacity of 250 tons per hour, aerial tramway, 120-yd-per-hour mixing plant, and two 1,650-ft cableways.

Fishways. First Salmon Pass Bonneville Dam. *Eng. News-Rec.*, vol. 120, no. 21, May 26, 1938, p. 733. First report on performance of $6,500,000 fishways of Bonneville Dam.

Foundations. Parker Dam—Sets a Record for Foundation Depth, L. P. Sowles. *Western Construction News*, vol. 13, no. 3, Mar. 1938, pp. 96–101. Progress report on initial stage of construction of Parker Dam for Colorado River aqueduct, being built by Metropolitan Water District of Southern California; procedure developed to permit excavation through 250 ft of river deposit; pumping requirements total 37 cu ft per sec; concrete production and placing.

Hydraulic Fill, Construction. Novel Earth Handling at Quabbin Dam, F. W. Gow. *Eng. News-Rec.*, vol. 120, no. 20, May 19, 1938, pp. 709–712. Description of Boston water-supply dam 2,640 ft long, 170 ft high; hydraulic fill placed by gravity flow from high-level hog box fed by series of belt conveyors from three borrow pits; excavating and conveying; mixing and sluicing.

Irrigation, United States. Upper Snake River Development—II—Grassy Lake Dam and Cross Cut Canal, I. D. Jerman and J. R. Sutherland. *Western Construction News*, vol. 13, no. 4, Apr. 1938, pp. 159–162. Outline of plans for construction of Grassy Lake earth-fill dam, maximum height 120 ft, 1,200 ft long, on Grassy Creek, Wyoming; also of two diversion dams and of Cross Cut Canal, over 7 miles long, with maximum capacity of 760 cu ft per sec.

Reservoirs, Lining. Use of Asphalt as Protection for Reservoirs and Dams, J. E. Buchanan. *Am. City*, vol. 53, no. 5, May 1938, pp. 73 and 75. Experience with asphalt lining of three small water-supply reservoirs in Southern California; design and construction features; protecting and waterproofing upstream face of earth dams. Before 11th Nat. Asphalt Conference.

Rock-Fill, Algeria. Algerian Rock-Fill Dam Substructures, I. Gutmann. *Eng. News-Rec.*, vol. 120, no. 21, May 26, 1938, pp. 749–751. Description of monumental cutoff walls, grout curtains, and under-drainage provisions of recently completed Algerian placed rock-fill dams described in article previously indexed from *Eng. News-Rec.*, Dec. 2, 1937; vertical joints permitting movement in cutoff walls; new K.L.M. process of chemical grouting, with water-glass and salt solutions, pre-mixed and pre-treated, injected simultaneously and setting after predetermined interval.

FLOOD CONTROL

Floods, Forecasting. Die Hochwasservoraussage, J. Wallner. Berlin, Julius Springer, 1938. 65 pp., diagrs., charts, tables, 7.50 rm. Book aims to provide practical directions for flood prediction; first section describes present methods and discusses their uses; second section presents method that is intended to be exact and generally applicable. Eng. Soc. Lib., N.Y.

FLOW OF FLUIDS

Flow of Water, Pipe Bends. Flow of Water Through 6-Inch Pipe Bends, D. L. Yarnell. *U. S. Dept. Agric.—Tech. Bul., No. 577*, Oct. 1937, 117 pp., 15 cents; see also *Eng. News-Rec.*, vol. 120, no. 22, June 2, 1938, pp. 777–778. Experiments on flow of water through 90-deg bends in 6-in. circular pipe of hyperbolic and elliptical cross-section with varying or constant radii of curvature, and on 90-deg miter bend; velocity pressure changes in bend; secondary currents; loss of head; pipe bends as flow meters; practical applications of tests.

Hydrodynamics. La mécanique du poisson de riviere, G. Denil. *Annales des Travaux Publics de Belgique*, vol. 39, no. 1, Feb. 1938, pp. 131–171. Hydrodynamics of fresh-water fish; mechanics of passage of fish through pressure conduits of circular cross-section with water flowing on account of difference in head; negative wave generated by presence of fish in such conduits. (Continuation of serial.)

FOUNDATIONS

Construction Equipment, Vibrating. Das Ruetteldruckverfahren und seine Anwendung im Erdund Betonbau, H. Schneider. *Beton u Eisen*, vol. 37, no. 1, Jan. 5, 1938, pp. 1–7. Application of author's original compressive vibrating equipment for compacting foundation soils, sinking and construction of piers and piles, etc.; ground consolidation.

Retaining Walls, Design. Locating Retaining-Wall Stems, W. M. Borgwardt. *Eng. News-Rec.*, vol. 120, no. 22, June 2, 1938, p. 790. Easy method of determining exact location of stem in designing cantilever retaining walls so that required base width is of minimum dimensions.

HYDRAULIC ENGINEERING

Water Hammer. Water Hammer and Resultant Damage Can Be Avoided by Proper Drainage of Steam Pipes, C. L. Hubbard. *Textile World*, vol. 88, no. 7, June 1938, pp. 60–61. Steam piping in textile mill actually contains varying amounts of water along with steam; this is due to condensation in equipment with which it connects and in piping system; notes on water hammer, damage to boilers, direction of flow, drip connections, separators, and unit heaters.

HYDROELECTRIC POWER PLANTS

Uruguay. Rio Negro Hydroelectric Scheme, W. Borkenstein. *Civ. Eng.* (London), vol. 32, no. 378, Dec. 1937, pp. 436–441. Outline of project now in course of construction, including Noetzli-type multiple-arch dam about 800 m long; maximum height 35 m above river bed.

INLAND WATERWAYS

Hydraulics. Experimental Investigation of Effect of Bridge-Piers and Other Obstructions on Tidal Levels in Estuary, A. H. Gibson. *Instn. Civ. Engrs.—J.*, no. 5, Mar. 1938, pp. 210–233, (discussion) 234–248. Results of hydraulic model study of effect of bridge pier obstructions of various magnitudes on estuaries of Severn River and other British rivers; tests on model of symmetrical tidal estuary.

IRRIGATION

India. Report for Year Ending April 1937. *Punjab Irrigation Research Inst.—Report 1937*, 222 pp., figs., diagrs., tables, maps. Annual report of various sections of Institute outlining progress in study of problems connected with waterlogging and alkali accumulation in irrigated lands, prevention of seepage by lining canal beds with earth treated with sodium carbonate, watershed corrosion, flow under irrigation structures and in open channels, tests on hydraulic models of rivers, canals, irrigation structures, etc.

Irrigation Canals, Stream Crossings. Drainage Works Across Canals, P. K. R. Sharma. *Indian Eng.*, vol. 103, no. 2, Feb. 1938, pp. 49–50. Discussion of method of passing stream drainage over irrigation canals by auto-suction weirs, spillway siphons, and venturi flumes; head loss; results of experimental study of performance of auto-suction weir.

Land Valuation. Die Wasserfrage bei der Bodenschaetzung, W. Weisbrod. *Braunkohle*, vol. 36, no. 49, Dec. 4, 1937, pp. 877–883. Water problem in land valuation; it is claimed that lowering of ground-water surface can result in lower crop yield only when ground-water surface and strata influenced thereby are depressed below level of plant roots into depths not within reach of roots; conclusions with respect to valuation of land. Bibliography.

MATERIALS TESTING

Concrete, Disintegration. Neuere sowjetrussische Arbeiten auf dem Gebiete der Korrosion und des Korrosionsschutzes von Beton und Zement, M. von Pohl. *Korrosion u Metallschutz*, vol. 13, no. 12, Dec. 1937, pp. 417–424. Review of recent Soviet Union researches in field of corrosion and protection of concrete and cement; brief abstract of papers published within past few years.

Concrete Testing, Bond. Die Haftfestigkeit von Rundstahl im Vergleich mit Knotenstahl, F. von Emperger. *Beton u Eisen*, vol. 37, no. 2, Jan. 20, 1938, pp. 31–33; see also English abstract in *Am. Concrete Inst.—J.*, vol. 9, no. 4, Mar.–Apr. 1938, pp. 533–534. Results of tension tests of concrete beams to determine bond strength of plain and deformed reinforcing bars; influence of different concrete strengths in comparison with influence of different cements; elastic recoveries and plastic deformations with repeated loads.

PORTS AND MARITIME STRUCTURES

East London, South Africa. East London Harbour Improvements. *Engineer*, vol. 165, no. 4285, Feb. 25, 1938, pp. 212-214 and 222. Illustrated description of extension of harbor facilities, including turning basin and extension of new quay; construction of basin and quay walls; flooding of cofferdam.

Naples, Italy. Maritime Station at Naples. *Engineering*, vol. 145, no. 3762, Feb. 18, 1938, pp. 179 and 182. New station built on Luigi Razza Quay; main sections are 590 ft long, 90 ft wide, and rise to height of 72 ft from quay level; main structural members of building consist of four rows of reinforced concrete columns spaced 30 ft apart; two outer rows forming framework for external walls.

ROADS AND STREETS

Africa. La Rete Stradale dell'Impero, G. Pini. *Annali dei Lavori Pubblici*, vol. 76, no. 3, Mar. 1938, pp. 222–256. Report on highway systems and recent road construction, including bridges, in Italian Eritrea and in Abyssinia; organization of construction work; operation of highways.

Asphalt. Kombinierte Asphalteinstreudecke, E. Johannson. *Bitumen*, vol. 7, no. 9, Nov. 1937, pp. 185–188. Illustrated description of method employed in making combined asphalt-sprayed pavements.

Codes. Code Unifies Road Work, L. V. Murrow. *Eng. News-Rec.*, vol. 120, no. 21, May 26, 1938, pp. 754–757. Discussion of new highway code of State of Washington abolishing all previous road laws and starting new era of transport services free of needless restrictions; design standards for primary and secondary system highways; new engineering practices in roadway design and construction; revamping of highway sign system; control of operation; safety measures; weighing stations.

Design. Une solution à envisager pour le profil des autoroutes, M. Makcheeff. *Travaux*, vol. 22, no. 65, May 1938, pp. 204 and 214. Formulas for design of profiles of automobile highways, taking into account speed and dimensions of automobiles, also safe interval between two cars running at full speed.

Design. Road Conditions Governing Safety of Modern Traffic, T. Adams. *Engineer*, vol. 165, nos. 4287 and 4288, Mar. 11, 1938, pp. 276 (discussion) 279–280, and Mar. 18, pp. 317–318; see also editorial comment in *Engineering*, vol. 145, no. 3765, Mar. 11, 1938, pp. 271–272. Author's suggestions for planning national road system confined to stating a few broad considerations regarding fundamental aspects of problem. Before Instn. Automobile Engrs.

Maintenance and Repair. Portable Paving Plants Used by Oregon, H. W. Young. *Am. City*, vol. 53, no. 4, Apr. 1938, pp. 84–86. Description of Oregon State Highway Commission portable asphalt paving plants for patching and repair work throughout state, and for handling small jobs, such as bridge approaches; analysis of paving plant costs and performance.

Railroad Crossings, Elimination. Design of Bridges for Highway Grade Separations, A. Sedgwick. *Can. Engr.*, vol. 73, no. 15, Oct. 12, 1937, pp. 5–8. Study of savings effected in correct culvert design; advantages and economy of rigid-frame type of structure for highway-railway and highway-highway crossings; long skewed spans. Before Canadian Good Roads Assn.

Road Materials, Specifications. Report of Committee D-4 on Road and Paving Materials. *Am. Soc. Testing Matls.—Preprint mtg. June 27–July 1, 1938*, 43 pp. Activities of subcommittees; recommendations affecting standards; tests for abrasion of coarse aggregate and sieve analysis of aggregates; specifications for asphalt plant, stone, and slag for water-bound and bituminous macadam, for stone and slag for bituminous concrete, for low, medium, heavy, and extra heavy consistency tar, and for cut-back tar.

Sacramento, Calif. Street Work at Sacramento, C. R. Blood. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 195–197. Study of records and review of present conditions indicating satisfactory service of old pavements consisting of heavy gravel bases and soft asphaltum penetration macadam surface; patented pavements (1885–1912).

Soil-Cement. Soil-Cement Highway Base Advanced to Contract Stage. *Western Construction News*, vol. 13, no. 5, May 1938, pp. 184–186. Report on extensive experimental work of California Division of Highways which led to preparation of specifications and call for bids for this type of base course stabilization; equipment for job; preparation of surface; summary of construction proposals for soil-cement base; application of cement; mixing; compaction.

Structural Steel. Der Stahlbau auf dem zweiten Kongress der Internationalen Vereinigung fuer Bruecken- und Hochbau, F. Bohny. *Schweizer Archiv.*, vol. 3, no. 8, Aug. 1937, pp. 217–225. Steel construction at Second Congress of International Society for Bridge and Building Design, Berlin-Munich, Germany, in Oct. 1936; examples of notable steel construction in Germany, including Niederfinow boat lift, bridges, and viaducts of German superhighway, described and illustrated; review of some papers read.

Surveying. Road Vehicle and Traffic. *Eng. News-Rec.*, vol. 120, no. 23, June 9, 1938, pp. 823–826. Discussion of methods by which current road planning surveys are being applied to working out more efficient and safer highway transportation systems; grade crossing inventories; road plans and programs.

Traffic Surveys. Automatic Recorder for Counting Highway Traffic, R. E. Craig. *Pub. Roads*, vol. 19, no. 3, May 1938, pp. 37–51. Description, uses, and performance of photoelectric automatic highway traffic recorders; installation of traffic recorder; difficulties overcome in obtaining satisfactory performance; improved maintenance of machines; counter records used in expanding manual count data; cost of operating counters; attempts to develop portable counters.

SEWERAGE AND SEWAGE DISPOSAL

Aeration. Experiments in Aeration of Sewage, J. L. Beckett. *Civ. Eng.* (London),

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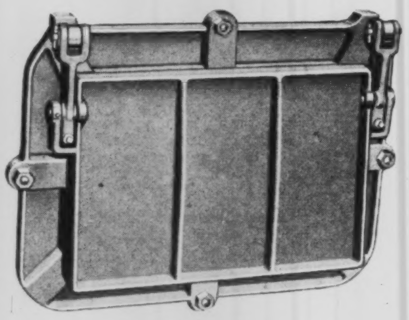

Fig. M-M

Made of all metal; upper hinge lugs are adjustable to provide correct seating even though foot walls are out of plumb; lower lip of nozzle is inclined downwardly and outwardly to increase velocity of very small flows to minimize deposit of sludge on seat; seats faced with non-corrosive metal if required; built to withstand back pressures due to 12′, 20′ and 40′ head.

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vol. 32, no. 376, Oct. 1937, p. 371. Report on experimental study of aeration of sewage, preliminary to design of extensions for sewage disposal plant of County Borough of Burnley, England.

ACTIVATED SLUDGE. Bulking of Sludge in Activated Sludge Process. *Can. Engr.*, vol. 73, nos. 11 and 15, Sept. 14, 1937, pp. 5–7, and Oct. 12, pp. 9–11. Extracts from report of Committee on Sewage Disposal of Engineering Section of American Public Health Association. Sept. 14: Control of sludge solids; rising sludge; cause and types of bulking; growths of filamentous bacteria; effect of addition of foreign materials; correction by use of lime. Oct. 12: Aeration; measures to cope with bulking; effect of iron and chlorine; control of filamentous bacteria; aeration and reaeration.

DENVER. Denver's New Sewage Plant Allows Flexible Operation, C. A. Davis. *Western Construction News*, vol. 13, no. 4, Apr. 1938, pp. 132–134. Design and equipment of new 54-mgd sewage disposal plant permitting variation from plain sedimentation to complete treatment; magnetite filters for effluent; plant buildings; major equipment units; sludge digestion.

DISPOSAL PLANTS, EQUIPMENT. Rex Triturator for Sewage Screenings, C. B. Townend. *Engineering*, vol. 145, no. 3765, Mar. 11, 1938, pp. 266–267. Review of paper before Public Works, Roads and Transport Congress, on elimination of detritus dump.

INDUSTRIAL WASTE. Effect of Trade Wastes on Sewerage Works, S. Shupe. *Can. Engr.*, vol. 73, no. 17, Oct. 26, 1937, pp. 44, 46, and 64. Effect on sewage disposal practice of effluents from tanneries, meat-packing plants, milk factories and dairies, gas manufacturing; leaks in mains.

INDUSTRIAL WASTES. Epuration des eaux residuaires, L. Fassina. *Chimie & Industrie*, vol. 38, no. 5, Nov. 1937, pp. 840–855. Purification of industrial waste waters. Part I deals with dyehouse waste waters—their classification, recovery vs. purification, toxicity and pollution, clarification, filtration, etc.; Part II deals with similar problems for tannery waters.

SLUDGE. Developments in Sewage-Sludge Incineration, M. B. Owen. *Can. Engr.*, vol. 73, no. 17, Oct. 26, 1937, pp. 56, 58, 60, and 64. Description of, and operating data on, several typical American sludge incineration plants; analysis of costs; effect of incineration on plant design.

WASTE UTILIZATION. Vergleich zwischen verschiedenen Stoffaengern, K. Lindovsky. *Papier-Favrikant*, vol. 35, no. 45, Nov. 4, 1937, pp. 429–432. Comparison between different save-alls; results of experiments carried out in Czechoslovakian paper mill, before installation of new Adka save-all, replacing old funnel-shaped equipment; description of new installation and savings effected.

STRUCTURAL ENGINEERING

ELASTICITY. Modified Theory of Elasticity, W. E. Lilly. *Engineering*, vol. 145, no. 3765, Mar. 11, 1938, pp. 279–280. In this theory it is assumed that volumes of isotropic solids do not change when strained within range of their elastic limits and, therefore, their specific gravity remains constant; application of theory to determination of stresses and strains in thick cylinder is considered.

FRAMED STRUCTURES, DESIGN. New Method of Designing Steel Framed Structures, H. N. Sil. *Indian Eng.*, vol. 103, no. 2, Feb. 1938, pp. 51–56. Outline of method of design for steel framed structures recommended by British Steel Structures Research Committee; beam designs; stanchion designs; beam connections; tabulated design data; numerical examples.

TRUSSES, VIERENDEEL. Vierendeel Girder or Triangulated Frame, A. Vierendeel. *Civ. Eng.* (London), vol. 32, no. 378, Dec. 1937, pp. 446–448. Translation of discussion of paper by L. Baes indexed in *Engineering Index*, 1937, p. 1203, from *Ossature Metallique*, Dec. 1936.

TUNNELS

VEHICULAR, GREAT BRITAIN. Some Features of Ventilation of Mersey Tunnel, E. B. Walker and J. R. D. Walker. *Instn. Min. Engrs.—Trans.*, vol. 95, pt. 2, May 1938, pp. 173–177, (discussion) 178–180. Semi-transverse system of ventilation; 30 fans, with total capacity of 10,016,000 cu ft per min, 15 in use and others held as standby; exhaust fumes from traffic, diluted by ventilating air from supply ducts, find way to nearest exhaust shaft and thence are discharged by exhaust fans through high chimney; plant; control room; indicating and recording instruments; tests.

VEHICULAR, NETHERLANDS. River Tunnel for Rotterdam, J. P. van Bruggen. *Civ. Eng.* (London), vol. 32, no. 376, Oct. 1937, pp. 363–364. Features of four-traffic-lane vehicular tunnels under Nieuwe Maas River, in Rotterdam, Netherlands, 1,070 m long; features of ventilating building; tunnel expected to be completed in 1941; cost about 15,000,000 fl.

WATER RESOURCES

UNDERGROUND, LONG ISLAND, N.Y. Underground Water Resources of Long Island, R. Suter. *Am. Water Works Assn.—J.*, vol. 30, no. 2, Feb. 1938, pp. 289–297. Geology of underground water supply of Long Island; distribution of fresh and salt water in absence of impervious strata; water used on Long Island; upperground-water surface on Long Island in 1903.

WATERSHEDS, DEVELOPMENT. Willamette River Program Approved by U. S. Engineers. *Western Construction News*, vol. 13, no. 4, Apr. 1938, pp. 146–149. Plan for $80,000,000 development of water resources on important Oregon stream, including construction of Detroit concrete arch dam, on North Santiam River, 259 ft high; reservoir program; cost of flood control storage; irrigation projects, areas, and storage costs; construction of additional power facilities; stream purification; fish protection.

WATER TREATMENT

CHLORINATION, GERMANY. 25 Jahre Trinkwasserchlorung in Deutschland, H. Bruns. *Gas u Wasserfach*, vol. 80, no. 38, Sept. 20, 1937, pp. 659–665. Historical review of progress in water chlorination in Germany and the United States during the past 25 years; control of effectiveness of process by chemical means; effect of water chlorination on incidence of typhoid fever in Germany and the United States.

FILTRATION PLANTS, CAYUGA, N.Y. Cayuga Filter Plant, C. E. Elmendorf. *Am. Water Works Assn.—J.*, vol. 30, no. 2, Feb. 1938, pp. 273–279. Description of water intake and filtration plant of water works of Cayuga, N.Y., which derives its supply from Cayuga Lake; capacity 200,000 gal per day.

FILTRATION PLANTS, PALMYRA, N.Y. Palmyra Filter Plant, A. B. Squire. *Am. Water Works Assn.—J.*, vol. 30, no. 2, Feb. 1938, pp. 280–288. Description of water intake and filtration plant of Palmyra, N.Y., which derives its supply from Canandaigua Lake, serving population of about 3,000; construction cost about $313,000.

SEDIMENTATION. Hydraulic Characteristics of Various Circular Settling Tanks, G. E. Hubbell. *Am. Water Works Assn.—J.*, vol. 30, no. 2, Feb. 1938, pp. 335–353. Results of hydraulic tests of models that led to development of improved inlet for circular sedimentation tanks, which will increase solid removals now being obtained with accepted types of inlets; comparative flow characteristics of adopted and standard inlet designs.

WATER WORKS ENGINEERING

CHINA. Water Works in China, F. W. G. Clark. *Junior Instn. Engrs.—J.*, vol. 48, pt. 7, April 1938, pp. 295–327. Brief historical account of water supply of British Concession, Tientsin, and description of changes and developments made in works in recent years under direction of author.

HOUSTON, TEX. Surface Water Supply Recommended for Houston. *Eng. News-Rec.*, vol. 120, no. 23, June 9, 1938, pp. 818–819. Outline of project for new water supply at Houston, Tex., utilizing flow of San Jacinto River, having average daily capacity of 32 mgd.

JERUSALEM. Jerusalem's Water Supply. *Oil Engine*, vol. 6, no. 61, May 1938, pp. 20–21; see also *Gas & Oil Power*, vol. 33, no. 392, May 1938, pp. 112–118. Description of new Jerusalem water works of 3-mgd ultimate capacity, including pipe line about 37 miles long and four Diesel pumping plants equipped with 12 National 360-bhp Diesel engines; treatment of water.

RESERVOIRS, CONCRETE. Der neue Grossbehaelter der Wiener staedtischen Wasserwerke, R. Tillmann. *Gas u Wasserfach*, vol. 80, no. 38, Sept. 20, 1937, pp. 701–707. Description of new covered concrete distribution reservoir of water works of Vienna (Austria), having capacity of 144,000 cu m; claimed to be largest in the world.

RIGA, ESTONIA. Der Ausbau des neuen Grundwasserwerks der Stadt Riga, R. Pavels. *Gas u Wasserfach*, vol. 80, nos. 38 and 39, Sept. 20, 1937, pp. 677–683, and Sept. 25, pp. 716–720. History of Riga (Estonia) water works, beginning with surface water supply developed in 1660 and ending with 1936 development of ground-water supply; description of wells and pumping equipment operating at maximum lift of 70 m; construction of pipe lines; operating results of first year of new underground water supply.

SOUTH AFRICA. Durban's New Water Scheme. *Engineer*, vol. 165, no. 4288, Mar. 18, 1938, p. 318. Umgeni scheme, while providing in first stage for daily supply of 20,000,000 gal, can be developed to at least 50,000,000; estimated to cost £1,750,000 for daily capacity of 20,000,000 gal; dam wall is to be 1,380 ft in length and spillway will be 115 ft above surface of river; there will be four tunnels on aqueduct pipe line having total length of 1.24 miles.

SWEDEN. Die Wasserversorgung der schwedischen Gemeinden, A. Jerden. *Gas u Wasserfach* vol. 80, no. 38, Sept. 20, 1937, pp. 673–677. Review of water resources and development of water works in Sweden since 1649; description of Stockholm, Gotenburg, and Malmoe water works.

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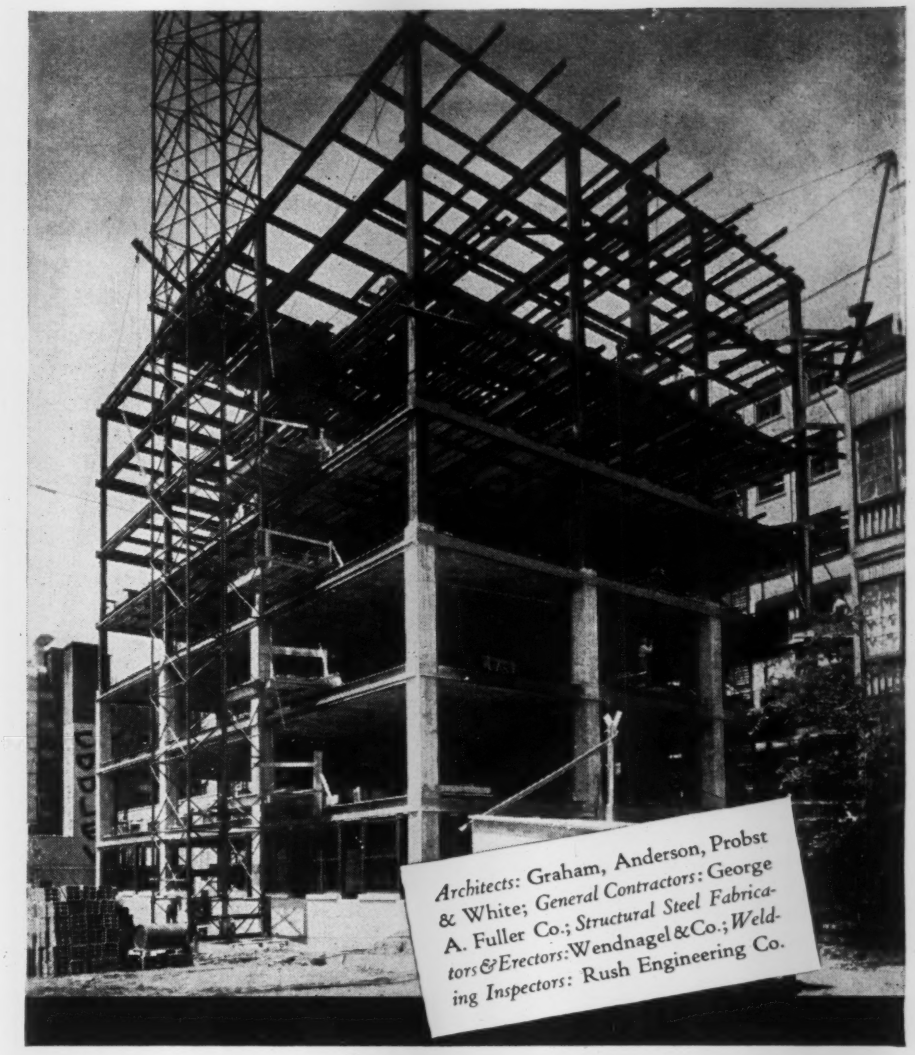

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Refers to V. L. Beavers, P. M. Ferguson, J. A. Focht, J. G. Turney.

Taylor, Seymour Stillman, Salt Lake City, Utah. (Age 24.) Designing Engr., Booth-Thompson Div., Galigher Co. Refers to T. C. Adams, R. B. Ketchum, F. H. Richardson.

Thornber, Chalmers Harvey, Hamilton, Mont. (Age 23.) Student Asst., Soil Conservation Service, acting Camp Engr., CCC. Refers to F. M. Brown, C. S. Heidel, A. W. Walker.

Tinniswood, William Walter, Berkeley, Calif. (Age 26.) Laborer and Chainman, California Div. of Highways. Refers to C. G. Hyde, C. T. Wiskocil.

Tobin, Robert Emmett, Midwest, Wyo. (Age 21.) Refers to E. W. Burritt, R. D. Goodrich, H. T. Person, J. D. Quinn.

Torrance, Thomas Curtiss, Hartford, Conn. (Age 22.) Refers to J. B. Babcock, 3d, J. D. Mitsch.

Unverferth, John Edward, Dayton, Ohio. (Age 22.) Refers to G. F. Baker, C. J. Belz, E. O. Brown, J. J. Chamberlain, Jr., J. F. Hale, B. T. Schad.

Wallace, Milton Irving, Balboa Heights, Canal Zone. (Age 21.) 2d Lieut., Corps of Engrs., U. S. Army. Refers to T. R. Camp, W. M. Fife, J. D. Mitsch.

Warnick, Francis Marion, Hinckley, Utah. (Age 21.) Refers to H. S. Carter, G. D. Clyde, O. W. Israelsen.

Wattles, Henry Starr, III, Alexandria, Va. (Age 23.) Lightkeeper, Triangulation Party, U. S. Coast & Geodetic Survey, Washington. D.C. Refers to W. Bowie, T. H. Evans, E. W. Saunder.

Weckerling, Leonard Eugene, Manhattan, Kans. (Age 23.) Jun. Engr. (C), Design Dept., Kansas State Highway Dept., acting as Rodman and Chainman on surveys. Washington, D. C. Refers to L. E. Conrad, M. W. Furr, L. V. White.

Welsh, Robert Eugene, Cleveland, Ohio. (Age 28.) Draftsman, Erie R.R. Co. Refers to W. M. Dawley, C. H. Splitstone.

Westkamper, Bernard Paul, Sacramento, Calif. (Age 22.) Axeman, U. S. Engr. Office. Refers to C. Derleth, Jr., F. S. Foote.

Whiston, Norman Davies, Omaha, Nebr. (Age 25.) Refers to M. I. Evinger, D. H. Harkness, H. J. Kesner, C. E. Mickey.

Wintz, William Aloysius Aloysius, Jr., Carville, La. (Age 23.) North West Dist. Spot Checker, State Office, AAA. Refers to J. H. Bateman, G. N. Cox, L. J. Muse, B. W. Pegues, F. F. Pillet.

Woodward, Walter Lewis, Cheyenne, Wyo. (Age 24.) Draftsman, Bridge Dept., Wyoming Highway Dept. Refers to H. D. Comstock, R. D. Goodrich, E. K. Nelson, H. T. Person, N. Williams.

Young, Edward Lee, Jr., Redding, Calif. (Age 26.). Refers to E. S. Borgquist, F. C. Kelton, J. C. Park.

FOR TRANSFER

FROM THE GRADE OF ASSOCIATE MEMBER

McClure, Thomas Mero, Assoc. M., Santa Fe, N.Mex. (Elected May 13, 1935.) (Age 43.) New Mexico State Engr.; Member and Secy., N.Mex. Stream Comm. Refers to E. L. Barrows, J. H. Bliss, P. S. Fox, F. G. Healy, B. Johnson, G. D. Macy, H. C. Neuffer, F. C. Scobey.

FROM THE GRADE OF JUNIOR

Allen, Charles Winsor, Jun., Columbus, Ohio. (Elected April 7, 1930.) (Age 32.) Asst. Engr. with Ohio State Highway Testing Laboratory. Refers to R. R. Litehiser, J. M. Montz, C. E. Sherman, R. C. Sloane, W. G. Smith, F. E. Swineford.

Bollman, Leslie Weber, Jun., Napanock, N.Y. (Elected Feb. 19, 1934.) (Age 29.) Eng. Asst., Board of Water Supply, Lackawack, N.Y. Refers to H. H. Cashdan, F. E. Foss, H. Holbrook, H. Newman, J. P. J. Williams.

Cadilla Ginorio, Ulises, Jun., Arecibo, Puerto Rico. (Elected Aug. 12, 1935.) (Age 32.) Associate Constr. Engr., Dept. of Interior, Puerto Rico RA. Refers to R. R. Casellas, M. Font, B. W. Pegues, A. S. Romero, E. Totti y Torres.

Collard, Arthur Ayres, Jun., North Haledon, N.J. (Elected Oct. 14, 1929.) (Age 32.) Draftsman, The Port of New York Authority. Refers to J. A. Darling, W. J. Delaney, C. W. Dunham, D. A. Nettleton, R. Smillie.

Collins, William Leighton, Jun., Urbana, Ill. (Elected Oct. 1, 1928.) (Age 32.) Associate, Dept. of Theoretical & Applied Mechanics, Univ. of Ill. Refers to H. Cross, J. O. Draffin, M. L. Enger, F. E. Fahy, W. C. Huntington W. M. Wilson.

Crandall, Frederick Bruce, Jun., Portland, Ore. (Elected Dec. 14, 1936.) (Age 32.) Div. Supervisor, Traffic Eng. Dept., Oregon State Highway Dept. Refers to F. T. Fowler, J. R. Griffith, G. W. Holcomb, F. Merryfield, C. A. Mockmore.

Dill, Frederick Hayes, Jun., Sewickley, Pa. (Elected Nov. 14, 1927.) (Age 32.) Mech. Eng. Dept., American Bridge Co. Refers to V. D. Beard, J. E. Elliott, C. F. Goodrich, F. S. Merrill, H. M. Priest, E. H. Rockwell.

Fletcher, Philip Nelson, Jun., Berkeley, Calif. (Elected Feb. 23, 1932.) (Age 32.) Asst. Bridge Engr., San Francisco–Oakland Bay Bridge. Refers to R. E. Davis, C. Derleth, Jr., V. A. Endersby, S. B. Lane, N. C. Raab, C. T. Wiskocil, G. B. Woodruff.

Higgs, George Washington, Jr., Jun., Parsons, W. Va. (Elected Oct. 24, 1932.) (Age 32.) Refers to J. A. Foley, N. A. Melick, L. Nadel, C. T. Schwarze, H. H. Snyder, C. Swecker, D. S. Trowbridge.

Hill, Harry Norton, Jun., Apollo, Pa. (Elected Dec. 5, 1927.) (Age 32.) Research Engr., Aluminum Co. of America. Refers to B. J. Fletcher, J. P. Growdon, E. C. Hartmann R. G. Sturm, R. L. Templin.

Hill, Leland Kerr, Jun., Asheville, N.C. (Elected March 11, 1935.) (Age 32.) Associate Civ. Engr., Appalachian Forest Experiment Station, U. S. Forest Service. Refers to W. B. E. Anthony, G. D. Clyde, O. W. Israelsen, J. P. Martin, H. V. Pittman, L. M. Winsor.

Johnson, Joe William, Jun., Washington, D.C. (Elected March 11, 1935.) (Age 30.) Asst. Engr., Soil Conservation Service, U. S. Dept. of Agriculture. Refers to H. L. Cook, G. C. Dobson, B. A. Etcheverry, R. S. Goodridge, G. H. Hickox, C. S. Jarvis, M. P. O'Brien.

LaFollette, Robert Meredith, Jun., Kansas City, Mo. (Elected May 11, 1936.) (Age 32.) Office Engr. with Charles A. Haskins, Cons. Engr. Refers to F. H. Austin, F. A. Belousek, C. H. Currie, H. R. Green, C. A. Haskins, M. L. Hutton, J. W. Ivy.

Lindeblom, Martin Albert, Jun., Salem, Ore. (Elected Oct. 14, 1929.) (Age 32.) Designer, Bridge Dept., Oregon State Highway Comm. Refers to L. F. Heuperman, C. B. McCullough, G. S. Paxson, T. C. Roake, R. T. Stanley.

McFarland, Clifton Benedict, Jun., Charleston, S.C. (Elected Oct. 1, 1926.) (Age 32.) Designing Engr., WPA, U. S. Navy Yard. Refers to A. D. Alexis, C. A. Arenander, A. E. Johnson, W. H. Latham, H. M. Sylvester, F. W. Wagener.

Quirk, William Henry, Jun., Albany, N.Y. (Elected July 8, 1935.) (Age 32.) Draftsman, New York Power & Light Co. Refers to G. C. George, A. E. Howland, W. K. Koch, W. H. Latham, R. P. Lent, S. M. Shapiro, E. W. Wolf.

Rollins, John Martin, Jun., Houston, Tex. (Elected Nov. 15, 1926.) (Age 32.) Field Representative, Ethyl Gasoline Corporation, New York. Refers to S. J. Buchanan, C. A. Chipley, W. Kenan, A. J. McKenzie, J. T. L. McNew, T. A. Munson, J. J. Richey, E. W. Robinson.

Rydeen, James Philip, Jun., Altoona, Kans. (Elected May 12, 1930.) (Age 32.) Asst. Topographic Engr., U. S. Geological Survey. Refers to M. J. Harden, J. M. Holmes, D. Kennedy, C. L. Sadler, J. G. Staack.

Wagner, Clifton James, Jun., Portland, Ore. (Elected Dec. 5, 1927.) (Age 32.) Lieut. (j.g.) in charge of Survey Party No. 9, U. S. Coast and Geodetic Survey. Refers to F. S. Borden, L. O. Colbert, F. L. Peacock, G. T. Rude, F. B. T. Siems, A. M. Sobieralski.

Waidelich, Alfred Thomas, Jun., Elmhurst, N.Y. (Elected Oct. 1, 1928.) (Age 31.) Engr., Estimating Dept., The Austin Co., New York City. Refers to H. L. Bowman, J. K. Gannett, C. M. Spofford, H. Sutherland, J. B. Wilbur.

The Board of Direction will consider the applications in this list not less than thirty days after date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 11 of the 1938 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

DESIGN

Hydro-Electric Engineer; Assoc. M. Am. Soc. C.E.; Licensed Professional No. 11044, State of New York; good draftsman, computer, and estimator; single; 25 years experience in design of reservoirs, dams—with their appurtenances, such as intakes, spillways, control gates, pipe lines, surge tanks, penstocks, power-house substructures, turbine settings, draft tubes, and tail-races. C-394.

EXECUTIVE

Executive Engineer; Assoc. M. Am. Soc. C.E.; experienced in operations, maintenance, production, and personnel. Experience also includes construction, efficiencies, cost analysis, servicing of equipment and machinery. Adviser to foreign military on refueling of planes. Published manual of engineering and operating standards. Age 36. Married. Former chief engineer and operating manager of large marketing firm. C-390.

Civil Engineer; M. Am. Soc. C.E.; graduate of Columbia University; 27 years design, supervision of construction, contracting, consulting, engineering education. Expert in cost estimating, construction methods, plant, purchasing, contracts, management, and supervision on heavy construction, foundations, and superstructures. New York State licenses. Available immediately. C-392.

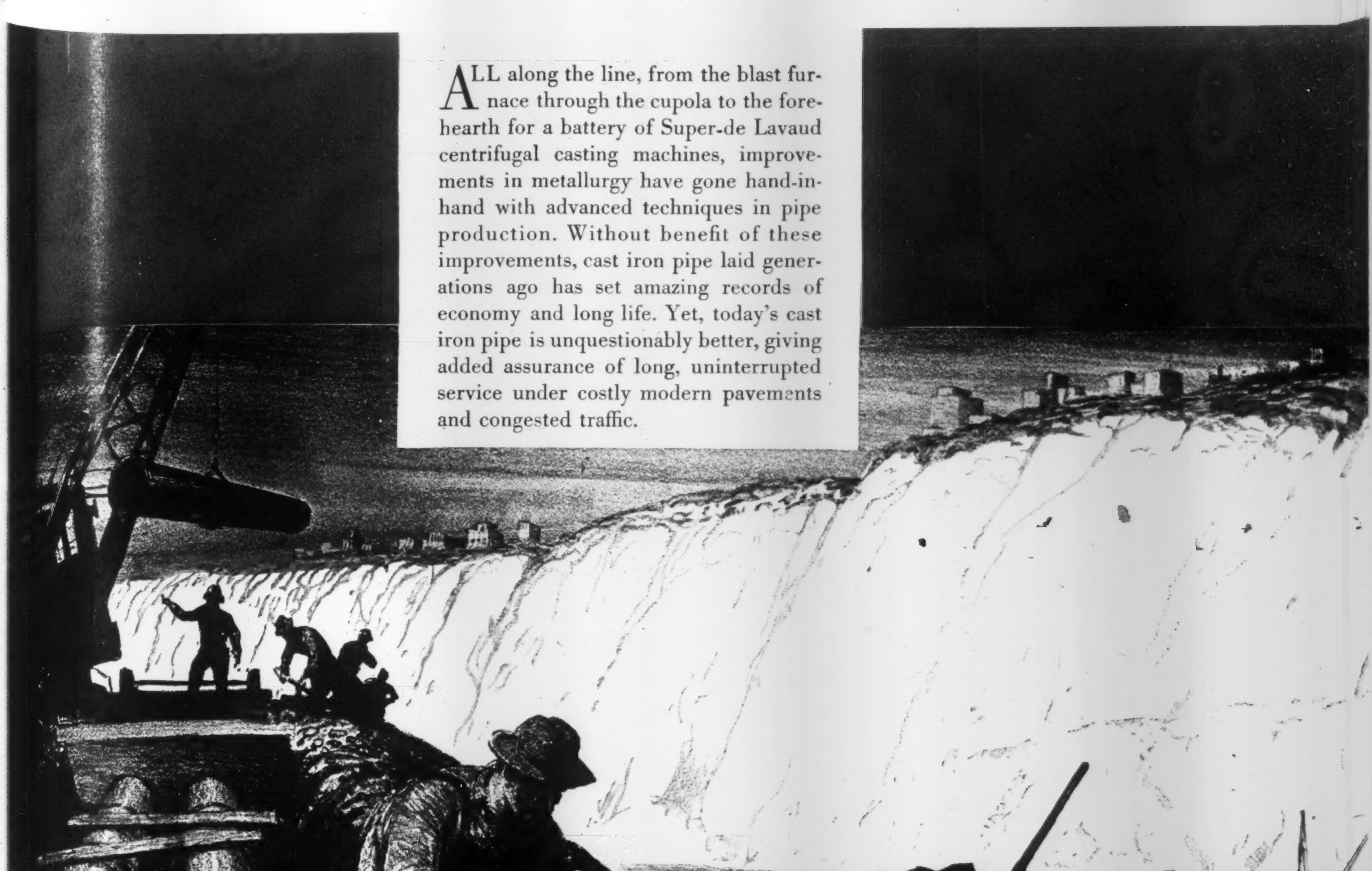
Executive Engineer; Assoc. M. Am. Soc. C.E.; 36; married; B.S.C.E., Massachusetts Institute of Technology, 1924; licensed professional engineer, New York State. Wide experience industrial plant and building design, specification, construction and maintenance, and administration of contracts. Desires position with contractor, engineer, or manufacturer where technical training, administrative experience, and business ability can be used. C-397.

Engineer-Superintendent; Assoc. M. Am. Soc. C.E.; 20 years construction, design, and valuation experience, in connection with hospitals, industrial buildings, central heating plants, residences, roads, land surveying, together with some selling and teaching experience. Best of references. Desires suitable position anywhere. Now in Michigan. C-403.

JUNIOR

Civil Engineer; Jun. Am. Soc. C.E.; 24; married; Georgia School of Technology, 1938; 3 years railroad maintenance work and drafting. Would like work in the building construction field. C-388.

Junior Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Union College; 2.2 years com-



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Junior Engineer; Jun. Am. Soc. C.E.; graduate of Rensselaer Polytechnic Institute; 28 years old; married; desires a position in a consulting engineer's office; 7 years experience in construction, surveying, and flood-control planning. Available September 1. Location immaterial. C-395.

Civil Engineer; Jun. Am. Soc. C.E.; 26; B.S. and C.E., College of the City of New York and University of Berlin; Phi Beta Kappa; 5 years experience as executive assistant and secretary to key men in industrial and technical fields. Desires similar position, or position as junior engineer in design, field, surveying, or sales. Available immediately. C-398.

Civil Engineer; Jun. Am. Soc. C.E.; 21; single; University of Maryland, 1937; Tau Beta Pi; Phi Kappa Phi; Scabbard and Blade; 10 months experience, railroad maintenance-of-way department, assistant in Corps of Engrs.; work included surveying and supervision. Desires position with future in design or construction of bridges or buildings. Available immediately. C-399.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; C.E. degree, Rensselaer Polytechnic Institute; varied experience in general contracting and engineering; inside as estimator and handling general office routine; field work as engineer and works superintendent in charge of building construction. Desires permanent position with future, not necessarily in construction. Location immaterial. Available on short notice. C-400.

Structural Engineer; Jun. Am. Soc. C.E.; 22; single; C.E., College of the City of New York, 1936; M.S., Iowa State College, 1938; 2 years research assistant with Iowa State College Engineering Experiment Station in concrete bridge-slab investigation. Knowledge of indeterminate stress analysis. Reads French, German, Spanish. Available immediately. C-401.

Junior Engineer; Jun. Am. Soc. C.E.; 25; married; B.S.C.E., Georgia School of Technology, 1937 (Co-op.); high scholastic record; now employed; field and office experience, federal and state road bureaus, railroad location and construction, sewerage, federal housing, and additional diversified. Desires change to permanent position on design or erection of bridges and structures, steel, or architectural concrete. Available on short notice. C-404.

Sanitary Engineer; Jun. Am. Soc. C.E.; 25; married; B.S.C.E., Yale University, 1935; M.S. in sanitary engineering, Harvard University, 1936; experience in surveying, construction 1 year in state health work; desires position in operation, design, or research, etc., in either water or sewage field. Practical worker with pleasing personality. Best references; available on short notice. C-405.

TEACHING

Civil Engineer; M. Am. Soc. C.E.; 37; now in responsible charge of dam construction, including placing and testing a million yards of rolled earth fill; desires teaching position in civil engineering department of university with opportunity for work in soil mechanics. Location immaterial. Available in September. C-389.

Instructor; Assoc. M. Am. Soc. C.E.; single; 32; B.S.C.E.; 15 years civil engineering experience covering supervision of highway construction, design and material research (soil mechanics); 4 years experience engineering teaching; desires permanent position teaching civil engineering or allied subjects with opportunity for graduate or research work; now employed as instructor. Available in September. C-396.

Structural Engineer; Assoc. M. Am. Soc. C.E.; licensed; 34; B.S.C.E. and C.E., University of Illinois; Tau Beta Pi; Chi Epsilon; 1 year, railroads; 2 years, varied; 8 years, highway bridge design; now permanently employed but desires to teach; indeterminate structures; theory of structures; materials of construction; steel, concrete, and wood design. C-402.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 108 of the Year Book for 1938. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Business Correspondence and Office Management. By E. A. Duddy, L. E. Frailey, and R. V. Cradit. Chicago, American Technical Society, 1938. 234 pp., illus., charts, tables, 9 × 6 in., cloth, $1.75.

The business letter and its importance, analysis of problems, letter form, and the various kinds of letters constitute the first section of this book. The second is devoted to the modern scientific technique of office management, including organization principles, filing methods, business machines, and other miscellaneous office equipment.

Civil Engineering Today. By E. Cressy. London and New York, Oxford University Press, 1938. 158 pp., illus., diagrs., maps, 9 × 6 in., cloth, $1.50.

This small volume provides a popular account of some outstanding modern bridges, tunnels, waterways, harbors, dams, power plants, water supplies, irrigation projects, etc., with brief outlines of the history of progress on these works. Excellent photographs add to the attractiveness of the book.

Contracts, Specifications, and Engineering Relations, 2 ed. By Daniel W. Mead. New York and London, McGraw-Hill Book Co., 1933. 557 pp., tables, diagrs., charts, 9 × 6 in., cloth, $4.

In this volume the author has discussed some of the important relations of the engineer and architect, with which the technical man should become familiar before entering professional practice. In this revised edition the chapter on Contracts has been entirely rewritten, enlarged, and expanded by Mr. Frank Jenks, of the Wisconsin Bar. The important relations of engineering to business and finance have been discussed, and numerous other additions and corrections have been made throughout the text.

Elements of Structural Engineering. By E. S. Sheiry. Scranton (Pa.), International Textbook Co., 1938. 476 pp., illus., diagrs., charts, tables, 9 × 5 in., leather, $4.

The aim of this book is to present the fundamental principles involved in the stress analysis and design of modern timber, steel, and reinforced concrete. Although it is planned primarily for college students who are not specializing in structural engineering, the needs of practicing engineers have also been kept in mind. The material is carefully chosen and clearly presented, and the book is an excellent condensed survey of the subject.

Essays in Science and Engineering, rev. ed., compiled by F. Montgomery and L. N. Becklund. New York, Farrar & Rinehart, 1938. 523 pp., charts, tables, 9 × 6 in., cloth, $2.

A collection of essays and articles on scientific and technical subjects designed to provide reading material for engineering English courses. The first part comprises a selection of more general essays, while the second and larger part consists of "expository models" for various kinds or technical composition.

(The) Evolution of Railways. By C. E. Lee. London, Railway Gazette, 1937. 64 pp., illus., diagrs., 9 × 6 in., cloth, 2s. 6d.

A history of permanent way from its earliest evidences in antiquity to the late nineteenth century, with particular reference to its development for the British mining and metallurgical industries.

Great Britain. Dept. of Scientific and Industrial Research. Building Research Board Report for the Year 1937. London, His Majesty's Stationery Office, 1938. 172 pp., illus., diagrs., charts, tables, 10 × 6 in., paper, 3s, 6d. (Obtainable from British Library of Information, 270 Madison Ave., New York, $1.10.)

This report includes a very complete summary of the investigations carried on during the year upon a wide variety of subjects connected with building. The topics discussed include materials, the structures and strength of materials, and the efficiency of buildings from the point of view of the user. A list of the reports and papers coming from the Board and its staff during the year is included.

Men and Iron, the History of the New York Central. By E. Hungerford. New York, Thomas Y. Crowell Co., 1938. 424 pp., illus., tables, 10 × 6 in., cloth, $3.75.

This history of the New York Central Railroad is mainly concerned with the beginnings, development, and consolidation of the smaller rail units east of Buffalo which went to form the original New York Central. The book is to a great extent written around the men whose foresight and energy carried on the work, and demonstrates the importance of railroad men and events in the progress of the country as a whole.

Momententafeln und Einflussflächen für Kreuzweise Bewehrte Eisenbetonplatten. By E. Bittner. Vienna, Julius Springer, 1938. 86 pp., diagrs., charts, tables, 10 × 7 in., paper, 9.60 rm.

The design of circumferentially loaded elastic plates is discussed, and tables intended to assist the designer of bridge floors and similar structures are presented. The formulas and methods of calculation used in preparing the tables are also described.

Public Administration Organizations—A Directory, 1938–1939, 4 ed. Chicago, American Public Works Association (1313 East 60th Street), 1938. 195 pp., $9\frac{3}{4}$ × 7 in., cloth, $1.50.

In addition to correcting and bringing up to date information contained in the third edition (published in 1936), this volume includes data on many new national and state-wide groups. Also, the "classified section" has been revised. The volume contains descriptions of approximately 500 national organizations and listings of 1,200 state, regional, and Canadian organizations, and is indispensable to public officials, economists, research workers, librarians, etc.

Sand, Gravel, and Other Aggregates. Methods of Testing. By J. Watson. New York, Chemical Publishing Co., 1938. 48 pp, illus., 9 × 6 in., cloth, $1.75.

Testing methods for sand, gravel, and other aggregates for use as construction materials, in molding practice, and as refractories. The importance, evaluation, procedure, and equipment of the tests are discussed.

Schwingungen in den Zuleitungs- und Ableitungskanälen von Wasserkraftanlagen. By J. Frank and J. Schüller. Berlin, Julius Springer, 1938. 200 pp., diagrs., charts, tables, 10 × 6 in., cloth, 28.80 rm.; unbound, 27 rm.

A treatise on the fluctuations in hydraulic power plant channels. The investigation of wave phenomena in open channels covers propagation and wave form and the mathematical handling of varying conditions in the head-water channel and the tailrace. The latter half of the book is devoted mainly to the mathematical determination of vibration amplitudes in surge tanks and pressure tunnels.

Squares—Logarithms and Gradients. By G. D. Inskip. Ann Arbor (Mich.), George Wahr, 1937. 811 pp. (plus additional pages of tables), diagrs., charts, 8 × 6 in., leather.

First published in 1925, the Table of Squares and Logarithms is indispensable to the structural draftsman. In this revised edition corrections have been made. The table has been compared with the author's Five Place Table of Squares, and when the decimal required further accuracy to determine the fourth place an eighth place was used and for the logarithms a ten-place table was used.

Symposium on Plastics. Rochester Regional Meeting, March 9, 1938. Philadelphia, American Society for Testing Materials, 1938. 51 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, $0.75; to members 50 cents.

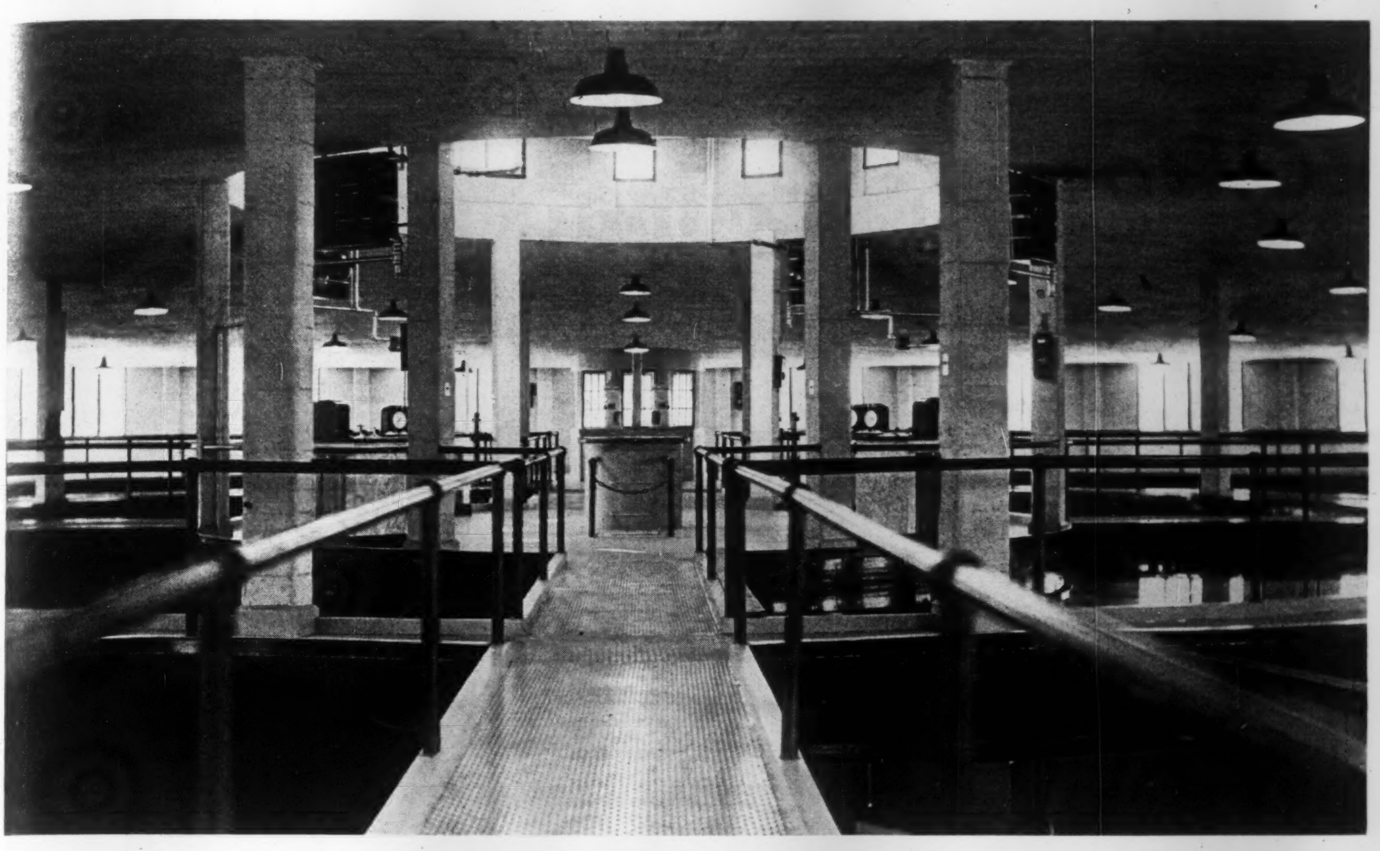
Six papers by authorities in the plastics field are contained in this pamphlet with some discussion material. Topics covered include the properties of an ideal plastic, various testing procedures, and hardness and permanence of plastics.

Trautwine, the Civil Engineer's Reference-Book. By J. C. Trautwine and J. C. Trautwine, Jr., ed. by J. C. Trautwine, 3d. 21 ed. Ithaca (N.Y.), Trautwine Co., 1937. 1650 pp., diagrs., charts, tables, 7 × 4 in., fabrikoid, $7.00; leather, $8.50.

"Trautwine" was first published in 1872 and for many years enjoyed supremacy as the reference book of the American civil engineer. The last previous edition appeared eighteen years ago. Much of the present issue is from the same plates, but some additions have been made, notably a long section upon hoisting, excavating, dredging and conveying machinery.

Water Supply and Sewerage. By E. W. Steel. New York and London, McGraw-Hill Book Co., 1938. 653 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $5.

The fundamentals of water-supply engineering and sewerage practice are presented in this volume. Essential information required to design and operate water and sewerage works is given in practical form. Of special importance is the discussion of the following topics: surface wash of water filters; mechanical mixing basins; use of "flocculators"; economics of water supply and sewerage systems; high-rate trickling filters; and sludge processing.

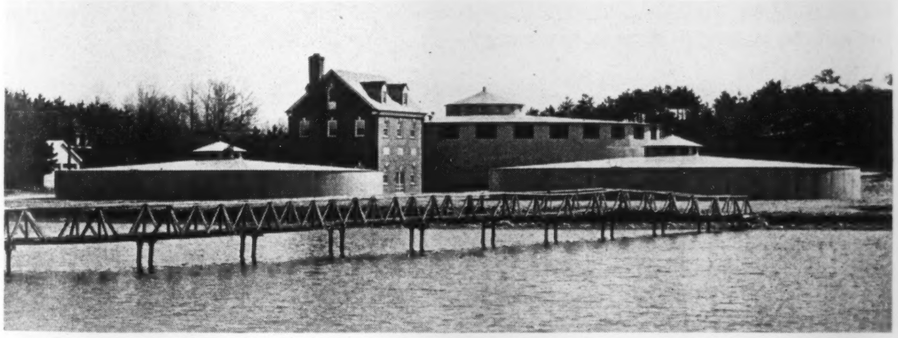


Look into this MODERN Rapid Sand Filter Plant

The Morse Filter Plant is a modern unit for filtering water by means of the rapid sand method. It is constructed entirely of steel. The various units of the plant, such as the pipe vault, filters, coagulating basins and filtered water reservoir, are arranged in concentric circles. The operating floor is located directly above the pipe vault. The filters may be open or covered as shown above.

Morse plants are built to your specifications. You may use any type of mixing equipment, controls, etc., you prefer. The various basins may be made the proper size to give the retention period you need.

Specific advantages of Morse plants include:



TOP: Interior view of 5 m.g.d. Morse filter plant at Bristol, Conn. Bottom: General view of plant showing two 400,000 gal. filtered water reservoirs in foreground.

BUILT OF STEEL—Steel is impervious, eliminating danger of seepage. Welded joints prevent leakage. The entire structure has long life.

COMPACT—Concentric design requires minimum space. This is advantageous where land values are high or large level areas not available.

LOW LOSS IN HEAD—Relatively low loss in head reduces operating costs.

EASILY INSPECTED—Large open underdrain permits inspection without removing filter beds.

LOW MAINTENANCE—All exposed surfaces easily accessible for painting.

FLEXIBLE—The filters may be operated at full or reduced rates or some shut down entirely to meet varying requirements.

ECONOMICAL—All of the concentric walls, except the outer one, serve two basins. Compact arrangement also reduces piping to minimum.

ALL CAPACITIES—Built in standard from $^1/_4$ to 30 m.g.d. Small sizes not penalized excessively in cost per m.g.d. of capacity.

Write our nearest office for a copy of our bulletin entitled The Morse Filter Plant or estimating figures on plants for specific locations.

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B 603

PLANTS in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

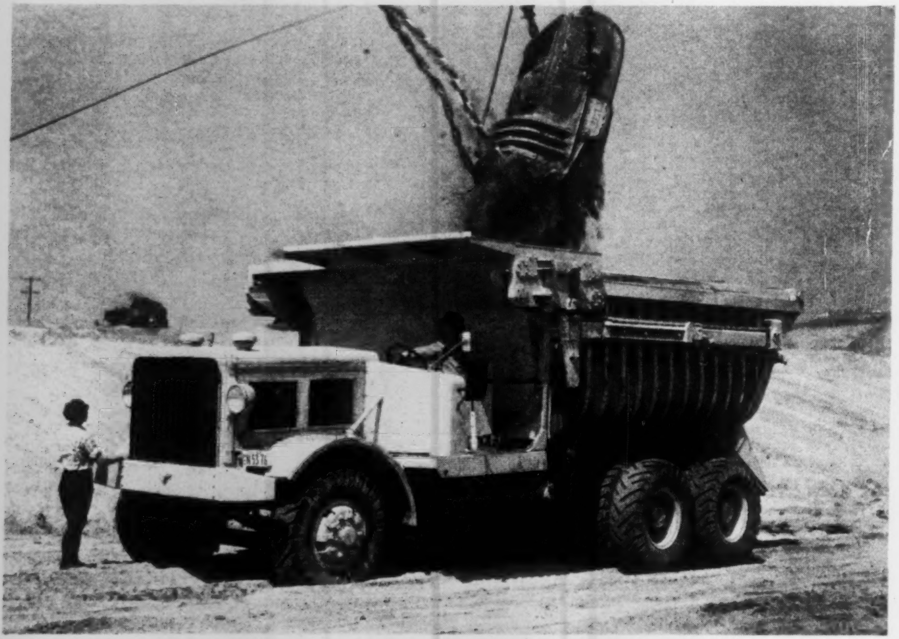
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

The Biggest Truck

A TRUCK OF 43-YD capacity, powered by a 180-hp "Caterpillar" Diesel engine, has been built by the Trojan Truck Manufacturing Co. of Los Angeles, California.

On a four-mile haul, it is reported, the truck will handle an average of 85 cu yd of material an hour, and do this work on approximately $3^{1}/_{2}$ gal of Diesel fuel. An especially designed tail gate makes it possible to load the unit to its maximum capacity regardless of the type of material being handled. It unloads in 45 seconds by means of a sliding bulkhead in the body that pushes the load out and spreads it simultaneously.



The Diesel engine is an 8-cylinder, V-type, with a bore of $5^{3}/_{4}$ in., and a stroke of 8 in. Turning at 1,100 rpm, it develops 180 maximum horsepower. Maximum torque is 1,025 ft-lb. at 650 rpm. The transmission is a unit power type having three speeds forward and one speed reverse, designed to take the torque and power output of the engine. An especially constructed auxiliary transmission has an overdrive, and underdrive, and a direct drive. The overdrive ratio provides an increase in speed of 40 per cent over that of the direct drive, giving a maximum speed of 25 miles an hour empty and 15 miles an hour loaded to full capacity. The underdrive ratio provides a 2–1 reduction allowing ample pulling power on average grades.

The truck is a twelve wheel drive with two sets of triple tired wheels in the rear. There are, in all, 14 demountable type disk wheels, 24 × 12 inches, having bolt circle diameters of $14^{1}/_{2}$ inches. The tires are 13.50 × 24 inches, 20 ply excavator type tread.

Armco Roofing

A NEW KIND of galvanized roofing with a patented spring-pressure lap and other exclusive features has been announced by The American Rolling Mill Company, Middletown, Ohio.

It is known as "Armco Galvanized Seal-Krimp roofing," and is said to be storm-proof, weather-tight, and easily installed. It is reported to cost no more than ordinary metal roofing per square applied. The new roofing is available in three grades of metal—copper-bearing steel, open-hearth steel, and Armco Ingot Iron. The company's new galvanized "Paintgrip" finish is recommended for roofs to be painted immediately. Roofing accessories are available.

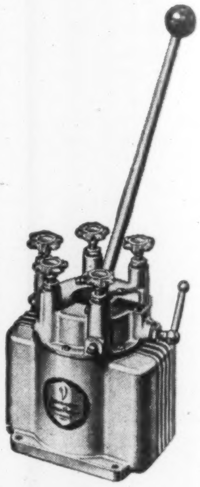
When Armco Seal-Krimp is placed in position and nailed down, the sections are held firmly together with spring tension at three points. Drainage channels and siphon breakers are built-in features. The pressure lap at the lower end of each sheet gives added protection, providing a pressure-sealed contact at the end laps and an effective water stop. The sections nest snugly together and cannot get out of alignment. Because of the spring pressure seam, Seal-Krimp must be laid one row or width at a time, starting at the eaves and working towards the ridge.

Roofing accessories available with Seal-Krimp include adjustable ridge roll, made in two pieces to fit any ordinary roof pitch, and end wall flashing and gambrel joints. Further information from the maufacturer.

Hand Power Unit

MULTI-POWER-PACKER is the name of a new hand-operated hydraulic power unit, for installation on all construction equipment requiring periodic raising and lowering of several parts.

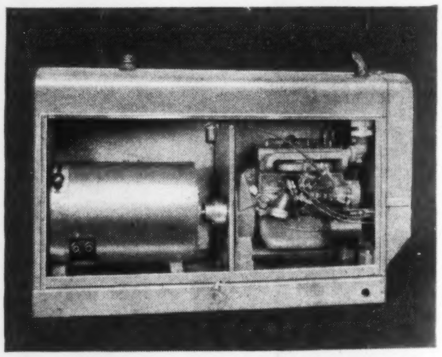
Multi-Power-Packer supplies dependable hydraulic power to operate one to five rams—independently of each other, or all together, or in any combination. Five selector valves permit selective action on individual rams, while a single control valve gives simultaneous control over any combination of rams.



The features claimed are ease of operation—one-man, one-hand control; wide range of adaptability—7, 10, 20, and up to 50-ton rams; low initial cost. Blackhawk Manufacturing Co., Milwaukee, Wisc.

"Special" Arc Welder

THE HARNISCHFEGER CORPORATION announces the new P&H-Hansen 200-ampere "Special" engine-driven welder. Consisting of a 200-ampere, commercial rated 30-volt 6-kw generator with an intermittent welding range of 35 amperes to a maximum of 225 amperes, the "Special's" generator is connected by a flexible coupling to a Continental 24-hp, 4-cylinder, water-cooled gasoline engine. The engine is equipped for hand-starting and with magneto ignition system. The entire unit is mounted on a formed steel base and equipped with a fully enclosing sheet metal canopy having removable sides for easy access to all parts. Although the standard "Special" is a stationary type machine, it can be supplied with two-wheel pneumatic-tire running gear.



The "Special" is built to handle electrodes up to $^{7}/_{32}$ of an inch in diameter under continuous manual operation. The Harnischfeger Corp., 4400 West National Ave., Milwaukee, Wisc.

ANOTHER GOOD ROAD MADE BY GOOD ENGINEERING AND GOOD PRODUCTS

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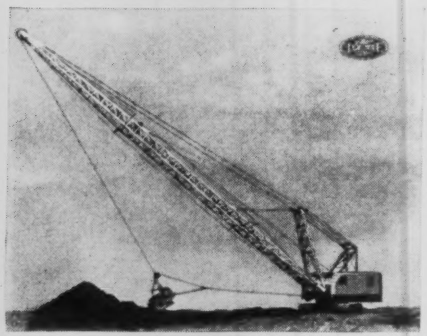
Socony 69M, Monomac Top, Standard Brand—Genesee County Road, East Bethany, N. Y.

Socony Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Socony Asphalt Emulsions • *Specifications and all other particulars furnished on request.*

SOCONY-VACUUM OIL CO.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

Long Boom Dragline

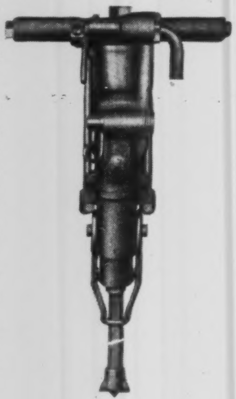
A SPECIALLY DESIGNED, 100-ft. aluminum boom has been developed with a $1^{1}/_{2}$ yd bucket on the standard P&H Model 955-LC, which normally is equipped with an 80-ft boom for handling a $2^{1}/_{2}$ yd bucket. This new aluminum type boom is equipped with a stiff leg gantry, which is a main factor in keeping the weight of the boom within the allowable maximum and which practically eliminates bending. This type of boom produces a favorable angle between the boom topping line and the boom. Harnischfeger Corp., 4400 West National Ave., Milwaukee, Wisc.



Lightweight Jackhamer

INGERSOLL-RAND COMPANY, 11 Broadway, New York, N.Y., announces a new Jackhamer, the JA-35. It is a light weight yet extremely powerful drill, styled after the widely used JA-45 and JA-55. It is reported to do a surprising amount of work per cubic foot of air used, and to readily handle all general light Jackhamer work with ease.

Weighing less than 35 lbs, it is a light weight, easy holding, fast drilling machine that finds application in mines, in quarries, and on construction jobs. Bulletin 2433 describes the JA-35, as well as other members of the Jackhamer family.



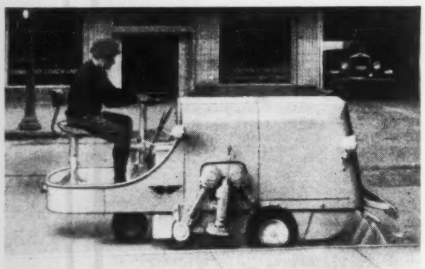
Aerial Map Contours

A CONTOUR FINDER for reading and measuring the third dimension on aerial photographic maps is the latest development of the Abrams Instrument Company, Lansing, Mich. According to the manufacturer's report, heights can be measured accurately by focusing on a given object and computing from a control point. Works along the principle of the "floating dot" system. A transcribing arm, working in conjunction with the Contour Finder, enables draftsmen to lay out two-dimension maps by copying directly from the aerial photograph.

Compact Street Sweeper

THIS NEW SWEEPER, "Byers White Wing," sweeps slightly more than a four foot width of street next to curbing at an average operating cost of four cents per curb mile plus operator's wages. It is reported to use less than 5 gallons of gas, a cupful of oil, and 3 ounces of grease to sweep 20 curb miles per day at a sweeping speed of 4.8 miles per hour. Because of its low purchase, operating, and maintenance costs, it brings power sweeping methods within reach of small cities.

The wire gutter broom scours hard packed dirt out of the gutter, throwing it in the path of the main broom. The main pick-up broom throws litter forward, directly into the half cu yd hopper without use of conveyor belts or drag elevators. Control of brush speeds is independent of travel speeds, and the main brush and gutter broom is each independently raised or lowered with almost micromatic exactness. Thus brush wear is reduced to the minimum. From a 60 gal tank, a fine spray of water is laid in front of the machine to dampen dust.



The sweeper is equipped with battery, electric starter, head lights, gutter spot, and tail lights for night operation plus other usual accessories. Simplified straight line flow of power from 15 hp motor, through disk clutch and one transmission delivers ample power for all operations. The Byers Machine Co., Ravenna, Ohio.

Packless Valve

THE MONAT VALVE and Forge Company, 952 Bessemer Bldg., Pittsburgh, Pa., has recently developed a packless, cylindrical gate valve, suitable for high as well as low pressures and temperatures.

This new, rugged valve, designated as the Monat "Stream-Flow," contains the salient construction features of both gate and plug valves, according to the manufacturer. It is available in sizes ranging from $^{1}/_{2}$ in. to 8 in. in the standard metals, and also in special metals and alloys for lines handling corrosive liquids and gases. The body of this new valve carries a cylindrical bore, at right angles to the line of flow. A cylindrical gate is moved up and down by means of a screw in the valve bonnet, and is prevented from turning by a key in the cylindrical bore. No packing is required. The only operating part in the line of flow is the gate itself. A cap on the bottom of the body and the removable bonnet permit cleaning the valve while it is in the line.

Literature Available

ARC WELDER—Their lines of welders and equipment are described in a booklet entitled "The Advanced Hobart Multi-Range Arc Welder." Hobart Brothers, Troy, Ohio.

BACKFILLER—A new and unique pipe line backfiller and pipe layer, the Cleveland Model 90 is covered in a small folder. Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland, Ohio.

BRAKE-MOTOR—These motors, used on hoists, cranes, conveyors, etc., are described in a 4-page folder, GEA-2026A. General Electric Co., Schenectady, N.Y.

CENTRIFUGE—Engineers' reports of results accomplished and descriptions and illustrations of typical installations for the dewatering of sludges by centrifuge are given in a 24-page booklet recently issued by American Centrifugal Corp., 74 Trinity Place, New York, N.Y.

CRANES—A 6-page folder describes the advantages of lifting and carrying heavy loads with tractor power and a LeTourneau Crane. The crane lifts with the power of the tractor engine through a standard LeTourneau power control unit. R. G. LeTourneau, Inc., Peoria, Ill.

INDUSTRIAL RAILWAY CARS—The line of industrial railway cars and accessories is described in a 16-page booklet. Koppel Division, Pressed Steel Car Co., Inc., Grant Bldg., Pittsburgh, Pa.

MOTOR CONTROLS—A 12-page booklet, No. GEA-1724A describes the construction and the operation of the complete line of G-E controllers for synchronous motors. General Electric Co., Schenectady, N.Y.

RATE OF FLOW INDICATOR—A 4-page folder covers the construction and uses of the new Permutit Rate of Flow Indicator. The Permutit Co., 330 West 42nd St., New York, N.Y.

TRANSITE SEWER PIPE—Complete information on the use of Transite asbestos-cement pipe for sewer lines is given in the new illustrated brochure, "Transite Sewer Pipe." Sections of the brochure explain how Transite sewer pipe is said to lower installation, maintenance, and sewage treatment costs. Another section gives specifications for the pipe, a table of crushing strengths, and a list of the dimensions and weights in which the pipe is manufactured. Johns-Manville, 22 E. Fortieth St., New York, N.Y.

TRUCK CRANES—Bulletin TX-45, in 30 pages, completely describes and illustrates the many sizes, and uses of P&H truck-mounted cranes and excavators. Harnischfeger Corp., Milwaukee, Wisc.

TUNNEL LINERS—A 16-page bulletin on Armco Structural Steel Plate Linings for tunnels, shafts, caissons, and conduits illustrates the uses of Armco plate linings, and presents helpful design information. Ingot Iron Railway Products Co., Middletown, Ohio.

WELDING ALUMINUM—is the title of a 48-page book which was recently revised. It covers fusion welding; welded aluminum vessels; torch welding heat-treated aluminum alloys; welding castings; arc welding and resistance welding. Clear and concise descriptions, design sketches, and shop illustrations enhance its value. Aluminum Company of America, Pittsburgh, Pa.

NOTHING TAKES THE PLACE OF THE RUDDER

NOTHING TAKES THE PLACE OF CAST IRON PIPE

FROM the caravels of Columbus to the "Queen Mary," there has been no substitute for a ship's rudder. Since 1664, nothing has taken the place of cast iron pipe as an economical, long-lived material for underground mains.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirements but only cast iron pipe meets them all.

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Cast iron pipe is made in diameters from 1¼ to 84 inches.

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

Installing 24-inch cast iron pipe for water supply transmission line at Mamaroneck, N. Y.

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

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That's why more than 4,300,000,000 Du Pont Blasting Caps and Electric Blasting Caps have been sold and used.

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In the future, as in the past, Du Pont will continue to make the most dependable detonators—*and hence the safest detonators.* E. I. du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Delaware.

MOST DEPENDABLE DETONATOR IS THE SAFEST DETONATOR

BLASTING ACCESSORIES

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete. Discussion of Concrete Bridge Construction Trends, H. M. Hadley. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 220–223. Discussion of modern developments in the following: joint spacing and design, expansion provisions, cantilever spans at abutments, use of longer span lengths, architectural considerations and hollow box girder design.

Concrete, Design. Reinforced Concrete Bridge Design, C. S. Chettoe and H. C. Adams, with foreword by Sir H. Maybury. 2 ed. new and enl. London, Chapman & Hall, 1938. 412 pp., illus., diagrs., charts, tables, 42 s. Structural theory, concrete, design essentials, and live load on highway bridges; practical design data; piling, excavation, curves, expansion, bridge strengthening and widening, esthetics of design, and location problems. Eng. Soc. Lib., N.Y.

Concrete, France. Franzoesische Eisenbetonbruecken, S. Kiehne. *Bauingenieur*, vol. 19, no. $^{1}/_{2}$, Jan. 7, 1938, pp. 9–25. Features of important concrete-arch bridges recently constructed in France and in French colonies, including those of Plougastel, St. Pierre du Vauvray, La Roche-Guyon, Castel-Moron, and Qued-Mellegue in Tunis; construction of ancient masonry-arch bridge at Pont de l'Arche into modern concrete-arch bridge with spans ranging from 34 to 69 m in length.

Costs. Contract Unit Prices. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938 (adv. sec.), p. 12. Unit costs bid and construction of highway bridges in Oklahoma and Kentucky; gravel roads in New Hampshire.

Plate Girder, Great Britain. L.M.S. Railway and Canal Bridge at London. *Engineer*, vol. 165, no. 4294, Apr. 29, 1938, p. 484. Brief illustrated description of five-span steel bridge spanning London, Midland, and Scottish Railway and Derby Canal; erection of steelwork presented certain problems, owing to fact that traffic on canal had to be maintained; bridge is 260 ft 3 in. long with width of 80 ft between parapet walls; each of five spans consists of 14 riveted plate girders.

Railroad Equipment, Welding. Railway Welding Progress in 1937, O. Bondy. *Ry. Gaz.*, vol. 68, no. 22, June 3, 1938, pp. 1076–1078. Brief review of recent developments in welding of vehicles, station buildings and structures, bridges, and rails.

Rigid Frame. Tests of Rigid Frame Bridges, W. M. Wilson and R. W. Kluge. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June 1938, pp. 625–646. Abstract of forthcoming bulletin of University of Illinois Engineering Experiment Station on tests of bridge model 1.5-ft wide with span of 48 ft; influence ordinates for reaction components by unit loads; moment of crown and knee; effect of horizontal restraint of deck upon moment; cracks observed during test.

San Francisco–Oakland Bay. San Francisco–Oakland Bay Bridge. *Engineering*, vol. 145, nos. 3773, 3775, 3777, 3778, and 3780; May 6, 1938, pp. 491–493; May 20, pp. 553–555; May 27, pp. 583–585 and 598; June 10, pp. 641–643; and June 24, pp. 697–700 and 710, supp. plates. Similar descriptions indexed in *Engineering Index* 1937, p. 161, from various sources.

Specifications. British Standard Specification for Girder Bridge—III, IV, and V. *Brit. Standards Instn.—Brit. Standard Specification no. 153*—1937, 50 pp. Specification intended to apply to fixed girder bridges of spans up to and including 300 ft between centers of bearings. Part 3, loads and stresses; Part 4, details of construction; and Part 5, erection. Part 1 (on materials) and Part 2 (on workmanship) were issued in July 1922.

Steel Arch, Moving. Steel Arch Moved Lengthwise. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 876–877. Moving 230-ft span, 3-hinged steel arch over Androscoggin River at Rumford, Me., lengthwise 50 ft to provide for increased waterway; work involved building new layout of bridge moving runways, including jacking details for lifting span onto rollers.

Steel-Truss, Cairo, Ill. Multiple Cantilever Completed at Cairo, H. J. Engel. *Eng. News Rec.*, vol. 120, no. 26, June 30, 1938, pp. 901–902. Design and construction of recently completed steel-truss highway bridge having total length of 5,865 ft in which there are three main river spans of 800, 650, and 650 ft., respectively, to accommodate navigation and large flood flows; foundations at depth of from 52 to 72 ft below low water; steel erection; total cost of bridge and approach roads is about $2,500,000.

Steel-Truss, Peru. Verrugas Bridge, Peru, P. J. Risdon. *Engineer*, vol. 165, no. 4290, Apr. 1, 1938, pp. 354–356 and 366. New bridge of three main spans on steel towers carries single line of railway of 4-ft $8^{1}/_{2}$-in. gage, is 720 ft long; all spans are of deck type with riveted connections; mild steel of tensile strength of 28 to 32 tons per sq in. was used throughout; center span comprises two main girders of "Pratt" type with vertical end struts, divided into eight equal panels.

Steel Truss, Vierendeel. La rupture du pont-route soude de Hasselt, sur le Canal Albert, en Belgique. *Genie Civil*, vol. 112, no. 2913, June 11, 1938, pp. 497–500. Discussion of causes of failure of Hasselt welded steel Vierendeel bridge over Albert Canal in Belgium, previously described from various sources.

Steel, Welding. Les ponts métalliques soudes, H. Regis. *Annales des Ponts et Chaussees*, vol. 108, no. 3, Mar. 1938, pp. 399–413. Comparative discussion of French and German specifications for welded steel plate girder bridges.

Suspension, Germany. Les nouveaux ponts suspendus de Hambourg et de Cologne, G. Pigeaud. *Genie Civil*, vol. 112, no. 2912, June 4, 1938, pp. 474–476. Features of proposed new suspension bridges in Hamburg (main span 700 m long), and at Cologne (main span 378 m long).

BUILDINGS

Apartment Houses, Air Conditioning. 100% Outside Air for Dallas Apartments. *Heating & Vent.*, vol. 35, no. 7, July 1938, pp. 37–38. Design of year-round air-conditioning equipment in apartment house at Dallas, Tex., which uses 100 per cent fresh air passed over suitable cooling coil kept cold by water circulated over cooling tower.

Bank Vaults. New Vaults, Bank of France. *Engineer*, vol. 165, no. 4293, Apr. 22, 1938, pp. 446 and 448. Vaults comprise four parts—public room with separate small vaults rented to public, office, gold vaults, and machine rooms; machine rooms are situated in separate chambers on same level; vaults arranged so that all personnel of bank could, if necessary, live in them for several months without having to leave them.

Churches, Repair. Unbau der Mohammed Aly Moschee auf der Zitadelle von Kairo, C. Andreae. *Schweizerische Bauzeitung*, vol. 110, no. 9, Aug. 28, 1937, pp. 95–101. Details of reconstruction of foundations and domes of old Mohammed Aly mosque at Citadel of Cairo, Egypt; details of reinforced concrete construction; observations on swaying of towers due to solar radiation.

Fire Prevention. Fire Protection at Empire State, A. E. Pelzer. *Power*, vol. 82, no. 6, June 1938, p. 57. Description of specially equipped hand fire truck, easily handled by one man, which can be taken into any elevator or through any door in building; fire fighting equipment on truck includes all necessities to extinguish quickly and safely any fire that may occur in building.

Floors, Covering. Laying and Care of Rubber Flooring, W. von Denffer. *India Rubber World*, vol. 98, no. 3, June 1, 1938, pp. 44–45. Practices found to be satisfactory in Finland; details as to methods which should be followed in connection with installation and maintenance of rubber flooring.

Government Buildings, Air-Conditioning. Cooling Congress. *Power*, vol. 82, no. 6, June 1938, pp. 60–62. 4,800-ton chilled water system supplies conditioned air for four government buildings in Washington, including Capitol, old and new House office buildings, and Senate office building.

Hospitals, France. Le sanatorium militaire de Martel de Janville, près de Chamonix (Haute-Savoie), C. E. See. *Genie Civil*, vol. 112, no. 2913, June 11, 1938, pp. 485–490. Design, construction, equipment, and accommodations of Martel de Janville high altitude military sanatorium near Chamonix, French Alps, accommodating about 180 patients; cost over 11,000,000 francs.

Hospitals, Lighting. Lighting in Hospital, H. W. Alexander, F. B. Lee, and L. S. Ickis, Jr. *Ill. Eng. Soc.—Trans.*, vol. 33, no. 6, June 1938, pp. 523–539 (discussion) 539–544. Results of studies in a number of hospitals located in northern Ohio and Pennsylvania; need for glare-free and shadow-free illumination in areas occupied by patients; lighting requirements for hospital routine tasks, and proper color treatment of interiors as means of creating comfortable conditions; fundamental data are presented. Bibliography.

Office Buildings. Modernization of Utility Buildings Cannot Stop, E. I. Gushee and P. G. Heidman. *Elec. World*, vol. 109, no. 23, June 4, 1938, pp. 104–105. Investment needs for office and service buildings analyzed with respect to advantages and disadvantages of centralization and customer service.

Steel, Construction. Crane Climbs Into Building to Erect Steel Framing, G. C. Olsen. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, p. 845. Erection of structural steel frame for new chapel building at Mt. St. Scholastica's Academy in Atchison, Kans., by use of $^{1}/_{2}$-yd crane mounted on timber runway, built along one edge of first floor slab.

Vibrations. Prevention of Vibration in Buildings, J. F. Smith. *Chartered Surveyors' Instn.—J.*, vol. 17, pt. 12, June 1938, pp. 242–256. Discussion of paper previously indexed from issue of May 1938.

CONCRETE

Construction, Ornamental. Work of Committee on Architectural Concrete of Exposed Aggregate Type and Thomas Alva Edison Memorial Tower, J. J. Earley. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June 1938, pp. 589–601. General discussion of problems of American Concrete Institute Committee on Architectural Concrete of Exposed Aggregate Type; design of concrete used in construction of Edison Memorial Tower, with special reference to aggregate size and gradation and use of architectural concrete slabs for forms.

Construction, Vibrating. Portable Apparatus for Measuring Vibration in Fresh Concrete, G. L. Pigman, F. B. Hornibrook, and J. S. Rogers. *U. S. Bur. Standards—J. Research*, vol. 20, no. 5, May 1938, (RP1101) pp. 707–721, 3 supp. plates. Electromagnetic pick-up unit, and amplifier, and special electric integrating and differentiating circuits used in conjunction with cathode ray oscillograph for measuring instantaneous particle velocities, displacements, and accelerations, for measuring frequencies, and for showing wave forms of mechanical vibrations in fresh concrete.

Curing. Concrete Curing Compounds, H. S. Meissner and S. E. Smith. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June, 1938, pp. 549–559. Critical review of use of liquid membrane coatings permitted by U. S. Bureau of Reclamation in Western states, including bituminous coatings; clear coatings; test procedure; coal-tar cut-back; relative efficiencies; moisture loss for various curings; effect of delayed application of membrane-curing compounds; spray equipment for clear paraffin and for coal-tar cut-back compounds.

Dams, Concrete Gravity. Field Survey of Mass Concrete, F. R. McMillan. *Am. Concrete Inst.*—J., vol. 9, no. 5, May–June, 1938, pp. 561–572. Review of study by Committee 108 of American Concrete Institute attempting to find to what extent properties peculiar to mass concrete are responsible for conditions observed in massive structures. Study of condition of concrete in Crystal Spring Dam, California; Elephant Butte Dam, New Mexico; Arrowrock Dam, Idaho; Morris Dam, California; Boulder Dam, Colorado; etc.

Drydocks, Concrete Wood Blocks. Composite Concrete and Timber Blocking for Dry Docks, E. C. Seibert. *Soc. Naval Architects & Mar. Engrs.—Trans.*, vol. 45, 1937, pp. 65–71, (discussion) 71–80. Indexed in *Engineering Index*, 1937, p. 334, from Advance Paper no. 1, mtg. Nov. 18 and 19, 1937.

Light Weight. Zellenbeton als Isoliermaterial im Ingeniaurbau, W. van Jindelt. *Zement*, vol. 26, no. 50, Dec. 16, 1937, pp. 816–820. Cellular concrete as insulating material in construction industry; notes on its use for insulation of roofs from heat losses in winter and sun radiation in summer and for waterproofing; insulation of outside walls.

Mine Shafts, Lining. Die Schacht- und Brunnenringe aus Beton und Eisenbeton, H. Keppner. *Gesundheits-Ingenieur*, vol. 60, no. 51, Dec. 18, 1937, pp. 774–779. Principles of design of circular reinforced concrete rings for shafts and wells; numerical examples.

Mixing. Novel Concreting Plant at Pilot Knob. *Eng. News-Rec.*, vol. 120, no. 26, June 30, 1938, p. 896. Description of original concrete mixing plant for building channel and sidewalls of Pilot Knob wasteway on All-American Canal 5 miles west of Yuma, Ariz.

Ships. Eisenbetonschiffbau und Stahlersparnis. *Zement*, vol. 26, nos. 44 and 45, Nov. 4, 1937, pp. 721–724, and Nov. 11, pp. 734–736. Construction of concrete ships and conservation of steel; investigation of possibilities of its application under present conditions, based on review of experiences gained with construction of reinforced concrete ships during World War.

Shrinkage. Messung der Schwindkraft von Beton, P. M. Pflier. *Zement*, vol. 26, no. 40, Oct. 7, 1937, pp. 657–659. Measurement of shrinkage capacity of concrete; description of magneto-elastic method, based on property of ferromagnetic materials to change their permeability with tensile load and measurement of this change in permeability with a-c bridge; results of measurements; influence of quality of cement and of mixing ratio.

DAMS

Earth, Construction. Compacting Cohesionless Material, R. M. Strohl. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, pp. 850–853. Report on studies and field tests of compaction methods for building rolled-fill dam of sand for Franklin Falls project, on Pemigewasset River, in New Hampshire; maximum height 246 ft; critical void ratio of fine sand; effect of rolling.

FLOOD CONTROL

California. Flood Control in Orange County Ready for Early Start. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 883–884. Outline of Southern California project including eight earthfill dams, to cost $15,248,000; main features of eight earthfill dams for flood control in Orange County; spillway capacities are up to 4,000 cu ft per sec per sq mile for watershed of 5 sq miles.

China. Yellow River Flood, O. J. Todd. *Eng. News-Rec.* vol. 120, no. 25, June 23, 1938, p. 864. Brief report on present flood.

Industrial Plants. Flood Gates Protect Manufacturing Plant, J. E. Webster. *Eng. News-Rec.*, vol. 120, no. 23, June 9, 1938, pp. 820–822. Method of keeping backwater from Monongahela River from flooding Westinghouse plant at East Pittsburgh by flood gates and pumping plant in Turtle Creek; features of low-head pumps.

FOUNDATIONS

Caissons, Concrete. Controlled Caisson Sinking, L. F. Booth. *Eng. News-Rec.*, vol. 120, no. 26, June 30, 1938, pp. 897–898. Sinking 82-ft circular concrete caisson, which had to be spotted and leveled with precision for new power plant extension of Cincinnati Gas & Power Co.

Piles, Steel. Pulling Sheet Piles Underwater, H. L. Schlubach. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, pp. 848–849. Description of job-devised pinchers for gripping piles under water in pulling cofferdam sheeting, at Grand Coulee Dam.

Piles, Steel. Steel Sheet Piles and Steel Bearing Piles, A. Agatz. *Structural Engr.*, vol. 15, no. 6, June 1938, pp. 196–207. Discussion of paper before Instn. Structural Engrs. & Instn. Civ. Engrs., previously indexed from *Structural Engr.*, Nov. 1937.

Vibration Damping. Vibration Control, S. Rosenzweig. *Nat. Safety News*, vol. 37, no. 6, June 1938, pp. 36–38 and 85. Notes on impact and air-borne vibrations, resilience, resistance-to-sound conductivity, efficient isolation, and steel springs. Based on paper previously indexed from Am. Soc. Mech. Engrs.—Paper, mtg. June 6–9, 1938.

HYDRAULIC ENGINEERING

Alignment Charts. Rechentafel fuer Druckrohrleitungen, Dueker und Durchlaesse, K. Weiss. *Gesundheits Ingenieur*, vol. 60, no. 44, Oct. 30, 1937, pp. 674–675. Construction of alignment charts for design of pressure conduits, inverted siphons, and culverts.

Canals, Erosion. Du Buat's Experiments, F. W. Woods. *Engineer*, vol. 165, no. 4291, Apr. 8, 1938, pp. 386–388. Historical review; Du Buat was one of earliest research workers who discussed soil-erosive potential of streams of water; he defined "bottom velocity" as "velocity close to bed"; it is shown that his conclusions as to "bottom velocity" and mean velocity and "velocity close to bed" must have been mistaken, in spite of his apparently brilliant conceptions.

Hydrodynamics. Ueber einige Forschungsarbeiten aus dem Gebiete der Stroemungslehre, etc, Foettinger. *Schiffbautechnischem Ges—Jahrbuch*, vol. 39, 1938, pp. 240–263, (discussion) 263–265. Research in hydrodynamics and its applications; account of experimental investigation of fluid friction of rotating bodies; study of jet blowers used in tunnel ventilation; study of scavenging process in 2-stroke engines by method which makes air flow visible; and study of turbo-reversing gear and turbo-couplings.

Ship Models, Tanks. Die Geschichte und das Wirken der Schiffbautechnischen Versuchsanstalt in Wien, F. Gebers. *Schiffbautechnischen Ges—Jahrbuch*, vol. 39, 1938, pp. 421–427. History and activity of Shipbuilding Research Laboratory in Vienna; illustrated description of model tank testing and equipment.

HYDROELECTRIC POWER PLANTS

California. Shasta Dam and Power Plant. *U. S. Bur. Reclamation—Specifications*, no. 780, 1938, 160 pp., 114 supp. drawings. $5. Detailed specifications of drawings for construction of concrete gravity dam and hydroelectric power plant, described in several previously indexed articles.

Tennessee Valley Authority. Tennessee Valley Authority's Works. *Engineer*, vol. 165, nos. 4291 and 4292, Apr. 8, 1938, pp. 382–384, and 394, and Apr. 15, pp. 412–413 and 422. Review of annual report for fiscal year of 1937, giving comprehensive review of what organization has accomplished since it was created by Act of Congress of May 18, 1933; illustrated description of dams and other construction work.

HYDROLOGY AND METEOROLOGY

Ice Jams. Damage from Ice Accumulation at Niagara Falls. *Engineering*, vol. 145, no. 3769, Apr. 8, 1938, pp. 397–398 and 399. Illustrated description of conditions in January 1938, when ice accumulated to such an extent that one of power stations was put out of action and well-known Falls View Bridge between Canada and United States was destroyed.

Tides, Great Britain. Abnormal Tides in Thames. *Engineering*, vol. 145, no. 3775, May 20, 1938, p. 561. Article deals with meteorological and astronomical conditions obtaining, which resulted in abnormal tides on Feb. 12–13, 1938, along eastern shores of England.

INLAND WATERWAYS

Rivers, Regulation. Criteri generali per la regolarizzazione e utilizzazione di un corse d'acqua di pianura—a und caso particolare, P. Frosini. *Annali dei Lavori Pubblici*, vol. 76, no. 4, Apr. 1938, pp. 295–315. Principles of regulation of rivers and valley streams with special reference to case of Tiber River in Italy.

IRRIGATION

Salt Lake City, Utah. New Water Supply for Salt Lake City. *Eng. News-Rec.*, vol. 120, no. 26, June 30, 1938, pp. 899–900. Features of Deer Creek irrigation and water-works project which U. S. Bureau of Reclamation is building to double existing capacity of city system and provide for 1980 needs; Utah Lake dike for diminishing evaporation losses.

LAND RECLAMATION AND DRAINAGE

Drainage Pumping Plants. New Internal Drainage Station. *Oil Engine*, vol. 6, no. 62, June 1938, pp. 60–61. Catsholme Pumping Station, Methwold, takes water from Common Dike and pumps it into river Wissey; plant with capacity of 100 tons per min, and one of 70-ton capacity installed; both engines are Allen solid injection totally enclosed vertical units.

Ground-Water Control. Wellpoint Pumping System for Excavation Drainage. *Engineering*, vol. 145, no. 3775, May 20, 1938, pp. 559–560 and 566. Plan of fencing area with number of what are virtually wells, from which water is drawn off so that excavation may be carried out in dry, has been widely adopted in United States

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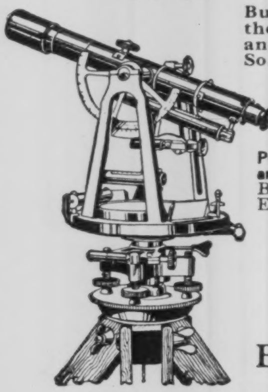

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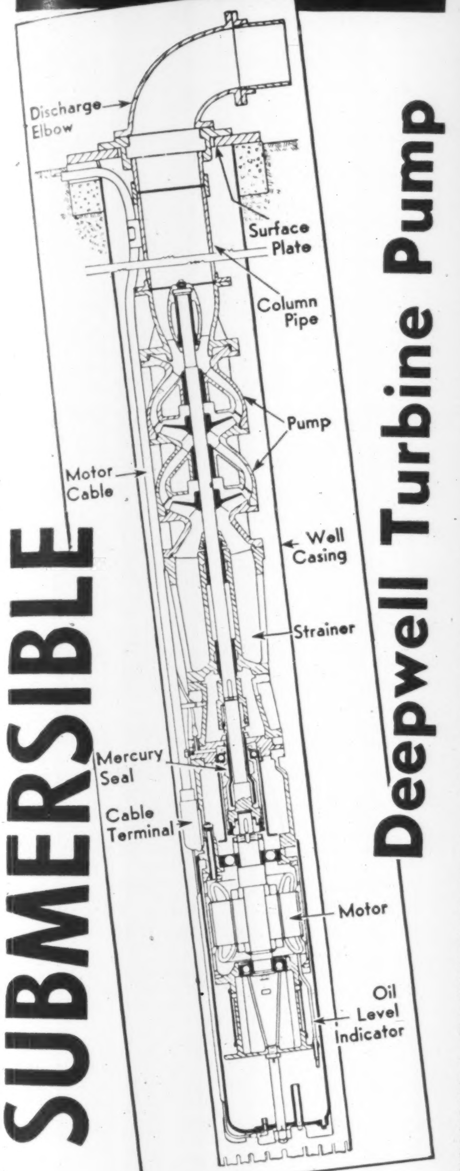

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Indo-China. L'amenagement hydraulique d'un grand casier dans le delta Tonkinois, O. Bigorgne. *Annales des Ponts et Chaussees*, vol. 108, no. 3, Mar. 1938, pp. 353–397. Design and construction of structures for combined drainage and irrigation projects, covering 110,000 hectares in river delta above Gulf of Tonkin, including levees, dams, drainage, and irrigation canals.

MATERIALS TESTING

Columns. Column Strength of Various Aluminum Alloys, R. L. Templin, R. G. Sturm, E. C. Hartmann, and M. Holt. *Aluminum Research Laboratories—Tech. Paper*, no. 1, 1938, 21 pp. Results of some 500 column tests made at Aluminum Research Laboratories on various aluminum alloys having wide range of mechanical properties, including flat-end and round-end structural shapes, tubes, and solid round rods; correlation of column strength with tangent modulus of materials.

Concrete. Druckfestigkeitsverhaeltnisse an Moertel und Beton bei einer Bauausfuehrung, H. Kolb. *Zement*, vol. 26, no. 50, Dec. 16, 1937, pp. 814–816. Determination and control of compressive strength of mortar and concrete during construction; results show under what conditions method is applicable.

Concrete. Some Time-Temperature Effects in Mass Concrete, J. W. Kelly. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June 1938, pp. 573–586. Study of relation of temperature rise to problem of cracking; factors affecting temperature rise; effects of temperature and other variables on mass concrete; effect of casting and curing at various constant temperatures on compressive strength; comparison of mass-cured and standard-cured concretes; elasticity, plastic flow, hygral length changes, thermal expansion; conductivity, specific heat. Bibliography.

Concrete Aggregates, Classification. Mittelbare Bewertung der Kornform von Zuschlaegen, O. Stern. *Zement*, vol. 26, nos. 42 and 43, Oct. 21, 1937, pp. 693–696 and Oct. 28, pp. 706–711. Evaluation of grain shape of aggregates; review of recent studies; physical constants of grain shapes; consideration of possibility of simplifying grain form values; compilation of test data; estimation of quality of grain shape.

Road Materials, Cement. Bemerkungen und Feststellungen zur Pruefung der Strassenbauzemente, O. Graf. *Zement*, vol. 26, nos. 45, 46, and 47, Nov. 11, 1937, pp. 729–732; Nov. 18, pp. 743–747; and Nov. 25, pp. 759–764. Testing of road cements; standard tests have been modified in past few years, in connection with construction of German superhighway; new test methods are also useful in bridge construction, concrete products industry, and concrete construction; discussion of problems that require further research.

Soils. Basic Principles of Soil-Cement Mixtures, F. T. Sheets and M. D. Catton. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 869–875. Basic principles governing use of soil cement mixtures for light traffic road laid down as result of laboratory research started by Portland Cement Association in January 1935, and still in progress; tests undertaken; test procedures; results of durability tests; progressive losses in soils due to wetting and drying; soil losses and volume changes due to alternate freezing and thawing.

PORTS AND MARITIME STRUCTURES

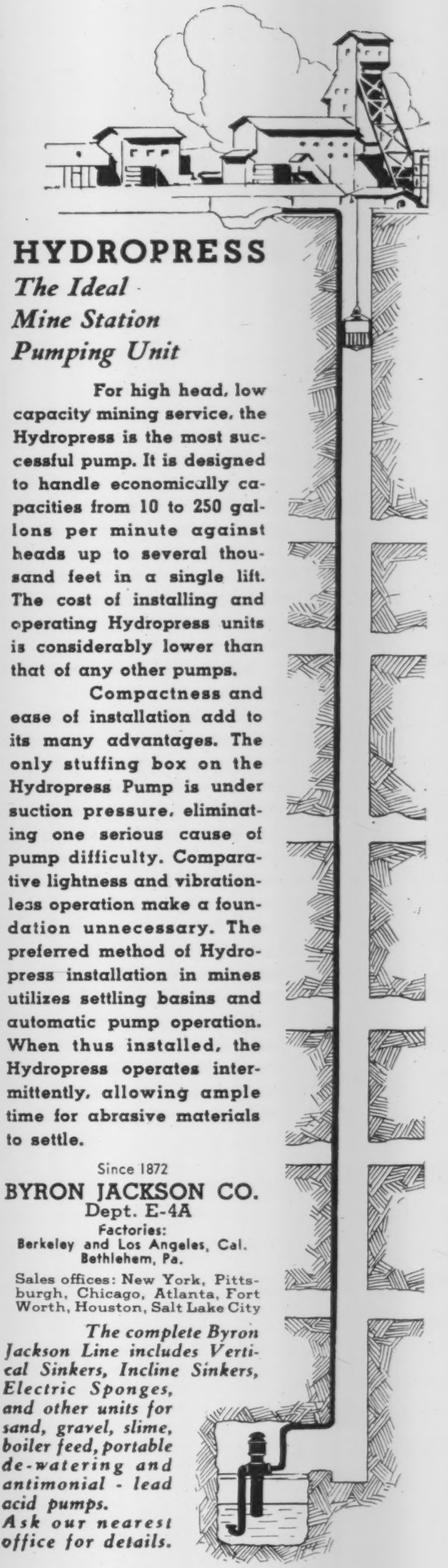
Anti-Aircraft Protection. Defence of Transport Against Air Attack, E. J. Hodsoll. *Inst. Transport—J.*, vol. 19, no. 7, May 1938, pp. 276–281 (discussion), 281–287; see also editorial review in *Engineering*, vol. 145, no. 3768, Apr. 1, 1938, pp. 359–360. Risks to which transport might be subjected in event of heavy hostile air attack are described, and an attempt is made to solve some problems which might result; figures showing penetration of various types of bombs and illustration of their capabilities; problems of road transport, docks, and inland waterways discussed.

Florida. Florida's Heavy Duty Port. *Naut. Gaz.*, vol. 128, no. 12, June 18, 1938, pp. 10–11 and 35. Statistical position of Port Everglades is discussed.

Galveston. Galveston—"Treasure Island," *Naut. Gaz.*, vol. 128, no. 12, June 4, 1938, pp. 16–18. History of port; commerce of city; port facilities; statistics.

Harbors. Harbor Accommodation. Services and Charges in Relation to Coasting and Overseas Trade, H. Hopperton. *Inst. Transport—J.*, vol. 19, no. 6, Apr. 1938, pp. 216–224 (discussion), 225–229. Commentary on traffic concentration, standardization, British practice of charging and accommodation, time factor, register tonnage, overseas practice, services, trades, cranage, dock signals and labor services, statutory authority, standard of costs, etc.

Model Testing. Note sur trois essais sur modèles réduits, F. Beau. *Annales des Ponts et Chaussées*, vol. 108, no. 3, Mar. 1938, pp. 339–351. Report on model tests made at Laboratory



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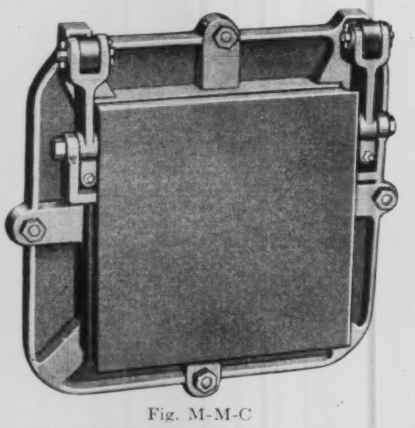

Fig. M-M-C

Figure M-M-C Gates are proposed for use under conditions of submerged discharge. The shutters are of cellular construction and of even thickness throughout. Designed to weigh 70 pounds per cubic foot of displacement. Stock sizes designed upon basis of 12′ head. Special designs for greater heads. Frames are cast iron with seats faced with non-corrosive metal when required. Shutters are regularly made of ferrous plates and formed sheets which are especially hot galvanized. We are equipped to coat gate frames and shutters with other non-corrosive metals when required.

Fig. M-M Gates are furnished with non-buoyant shutters and recommended for installation under conditions of free discharge. Built regularly for 12′, 20′ and 40′ head.

Stock Sizes

12″ x 12″	24″ x 24″	36″ x 36″	42″ x 63″
12″ x 18″	24″ x 36″	36″ x 48″	48″ x 48″
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18″ x 27″	30″ x 45″	42″ x 42″	

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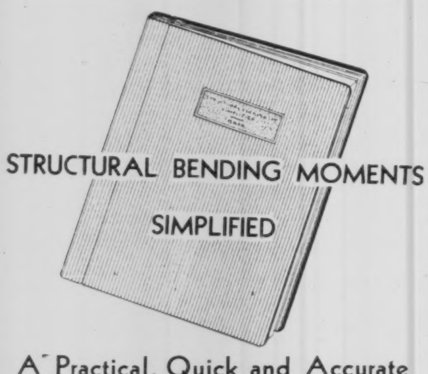

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RAILROAD STRUCTURES. Report of Committee XXV—Waterways and Harbors. *Am. Ry. Eng. Assn.—Bul.*, vol. 39, no. 402, Feb. 1938, pp. 639–653. Levees, dikes, and mattresses; ruling heights and widths in design of inland waterway craft which control vertical and horizontal clearances of bridges over waterways.

ROADS AND STREETS

DESIGN. Calculating Deflection Angles, J. J. Rettinger. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, p. 849. Simple rule for calculating deflection angles for any highway curve, for given radius.

DRAINAGE. Roadbed Design for Self-Drainage, H. C. Porter. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, pp. 842–844. Designed location of soils of different permeability in roadbed and fill to eliminate major hazard of gravity water to highway surfaces; water seepage through joints in pavement laid in trenched clay subgrade; rainwater impounded by tight clay soil shoulders; fills graded from impervious at bottom to pervious at top ensuring proper drainage.

FLOOD CONTROL, LOS ANGELES. Flood Control and Parkway Project Along Arroyo Seco at Los Angeles, H. W. Fraim. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 233–236. Construction of Arroyo Seco flood-control project in Los Angeles, Calif., including plant for superhighway and parkway design; construction of flood channels, largely by means of manual labor.

HIGHWAY LIGHTING. Light vs. Death. *Elec. West*, vol. 80, no. 6, June 1938, pp. 44–46. Trend of effect of daylight and artificial lighting on number of accidents shown in curve; outstanding examples of lighting systems of California Highway Commission at Bayshore; illustrated.

ITALY. Nuove costruzioni stradali nella Venezia Tridentina, G. Adami. *Annali dei Lavori Pubblici*, vol. 76, no. 4, Apr. 1938, pp. 322–333. Notes on construction of new highways and highway bridges in Venezia Tridentina section of northern Italy.

MAINTENANCE AND REPAIR. Some Maintenance Problems of Berkeley Street Work. H. Goodridge. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 218–219. Outline of routine maintenance practice for old oil macadam streets of Berkeley, Calif.

ROAD MACHINERY. Mechanical Float Finisher Used on Concrete Highways. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 213–214. Description of new machine consisting of series of wooden floats suspended from rigid steel frame mounted on four wheels; finishing portland cement paving surfaces with record speed and smoothness.

SUBSOILS. Presaturated Sand Bases, J. Montgomery. *Eng. News-Rec.*, vol. 120, no. 26, June 30, 1938, p. 902. Observations on road bases of sand indicating that to be sure sand is thoroughly compacted—after top of it is brought to proper line and grade—it should be thoroughly saturated with water.

SUBSOILS. Texas Tests Clay Subgrades, J. Montgomery. *Eng. News-Rec.*, vol. 120, no. 24, June 16, 1938, pp. 839–841. Discussion by Texas state highway engineer of recent observations on elaborate test road, for clearing up conflicting experiences with concrete pavement warping and heaving on clay subgrade; pavement movement; asphalt mat protection.

SEWERAGE AND SEWAGE DISPOSAL

DISPOSAL PLANT, LANSING, MICH. Lansing Pioneers in Garbage Digestion. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 878–880. Description of new 9-mgd activated sludge sewage-disposal plant now under construction at Lansing, Mich., where garbage will be digested along with sewage sludge; secondary treatment devices; pre-aeration tank for flotation of grease; sludge disposal facilities; garbage grinder and air ejector system.

DISPOSAL PLANTS, EQUIPMENT. Sewage Raising by Means of Pneumatic Ejectors, H. A. Hatt. *Junior Instn. Engrs.—J.*, vol. 48, pt. 4, Jan. 1938, pp. 150–161; see also *Civ. Eng.* (London), vol. 32, no. 377, Nov. 1937, pp. 416–418. Description of modern pneumatic ejector for sewage disposal; working cycle; compressed air supply; relative merits; application of ejector at Gosport.

DISPOSAL PLANTS, GREAT BRITAIN. Main Drainage of West Middlesex, M. W. Summers. *Junior Instn. Engrs.—J.*, vol. 48, pt. 8, May 1938, pp. 380–392. Development of West Middlesex; main sewerage; storm relief; purification; method of utilizing sludge gas and recovery of waste heat.

EXPERIMENTAL STUDIES. Rechengut- und Schammfaulversuche, J. Lesenyei. *Gesundheits Ingenieur*, vol. 60, no. 48, Nov. 27, 1937, pp. 731–733. Report from Budapest, Hungary, municipal sewage laboratory on experimental studies on effect of various vegetable and other admixtures on digestion of screenings and sludge.

GAS RECOVERY. L'emploi de gaz de digestion des boues d'égouts, De Prandlères. *Société des Ingénieurs Civils de France—Memoires*, vol. 90, no. 6, Nov.–Dec. 1937, pp. 794–806. Principles of gas recovery from sewage disposal processes; uses of gas recovered from sewage disposal.

METHODS OF DISPOSAL. Sewage Disposal. W. S. Lea. *Eng. J.*, vol. 21, no. 6, June 1938, pp. 267–276. Action of five common types of sewage treatment used in various plants as well as some of patented processes; disposal of sludge by incineration and digestion; pollution of streams.

PUMPING PLANTS, ELECTRIC CONTROL. Safe Pump Control on 4,000 Volts, M. R. Brice. *Power*, vol. 82, no. 2, Feb. 1938, pp. 50–52. Control of pumping equipment at sewage-treatment plant, Green Bay, Wis.; each pump direct coupled to vertical synchronous motor with direct connected exciter; motors are rated at 50, 75, and 150 hp, unity power factor, and operate on 4,000-v, 3-phase, 60-cycle power supply.

SEWERS, DESIGN. Abssussquerschnitte und Berechnungstafeln fuer Entwaesserungsleitungen, O. Schoenefeldt. *Gesundheits Ingenieur*, vol. 60, no. 47, Nov. 20, 1937, pp. 716–721. Numerical tables and graphical charts of hydraulic properties of various simple and composite cross-sections of sewers.

TRICKLING FILTERS. Durchflusszeit bei Tropfkoerpern, R. Penninger. *Gesundheits Ingenieur*, vol. 60, no. 52, Dec. 25, 1937, pp. 787–793. Theoretical and experimental study of flow through trickling filters of sewage-disposal plants; contact time and flow time. Bibliography.

WATER POLLUTION, GERMANY. Die Boeinflussung der Zwickauer Mulde durch Abwaesser, R. Wohlfahrt. *Gesundheits Ingenieur*, vol. 60, nos., 45 and 46, Nov. 6, 1937, pp. 682–688, and Nov. 13, pp. 699–704. Results of water-pollution investigation of Mulde River near Zwickau, Germany; discussion of various chemical reactions indicative of degree of pollution.

WATER POLLUTION, WISCONSIN. Green Bay Ends Sewage Pollution, J. Donohue. *Eng. News-Rec.*, Vol. 120, no. 23, June 9, 1938, pp. 815–818. Construction of intercepting sewers and sewage-disposal plant, with ultimate capacity of 12 mgd, to end pollution of Fox River, Wis.; flow diagram of pumping equipment and sewage-disposal plant; flexible joint cast-iron pipe used on river crossing; tunnels and river crossings; gas-holder for storing sludge gas; costs.

STRUCTURAL ENGINEERING

ARCHITECTURAL DESIGN. Modern Architectural Design, R. T. James. *Engineering*, vol. 145, no. 3766, Mar. 18, 1938, pp. 301–302. Editorial review of paper on Engineering Problems n Modern Architectural Design previously indexed from *Instn. Engrs. & Shipbldrs. in Scotland—Trans.*, Mar. 1938.

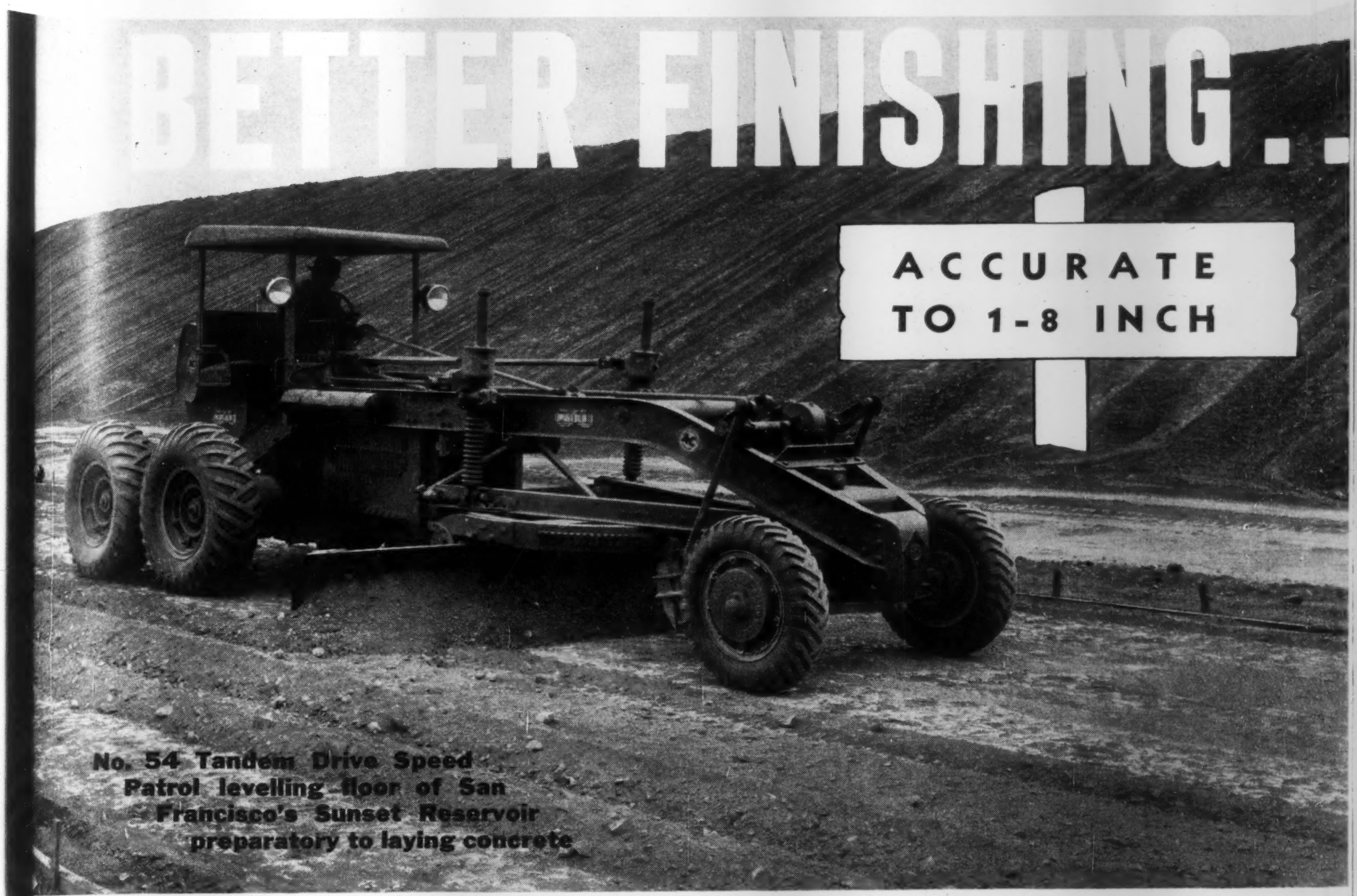
BUILDINGS, WIND EFFECT. Research Work on Wind Pressure in Belgium. *Engineering*, vol. 145, nos. 3773 and 3777, May 6, 1938, pp. 498–500, and June 3, pp. 638–639. Two centers of research arranged for in connection with work to be carried out—first concerns itself with wind action on panels and on facade of building, second deals with wind-tunnel experiments and tests on actual structures, and is centered at University of Brussels. From brochure published by Association Belge de Standardization.

CONCRETE DESIGN, CHARTS. Hilfswerte fuer die Berechnung doppelt bewehrter Querschnitte, W. Repenning. *Zement*, vol. 26, no. 47, Nov. 25, 1937, pp. 765–766. Calculation of doubly reinforced cross-sections; mathematical study and critical discussion of tables, based on latest German regulations for permissible concrete and steel stresses; according to these tables, with low static level, pressure reinforcement is theoretically higher than is structurally possible, and, vice versa, with high static level, it is theoretically lower than necessary.

CONCRETE SLABS, STRESSES. Der Einfluss verwindefester Unterzuege auf die Beanspruchung durchlaufender Eisenbetonplatten, Creemer. *Zement*, vol. 26, no. 51, Dec. 23, 1937, pp. 831–835. Influence of torsion-resisting girders on stresses in continuous reinforced-concrete slabs; method of calculation employing three-moments differential equation and supplementary-moments differential equation; example of application.

DOMES, CONCRETE. Principles of Concrete Shell Dome Design, E. C. Molke and J. E. Kalinka. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June, 1938, pp. 649–707. Theory of shell structures; calculation of shell domes with aid of stress function; measurements of deflections on shell structures; Z. D. barrel shell roofs; butterfly roofs; polygonal domes with shells of single curvature; shells of double curvature; buckling of shells; practical application of shell theory in United States. Bibliography.

RADIO TOWERS. Berechnung von Fischbauchantennen, E. Siegel, and W. Wiechowski. *Hochfrequenztechnik u Elektroakustik*, vol. 51, no. 5, May 1938, pp. 163–168. Calculation of spindle-shaped tower antennas; theoretical mathematical design analysis; damping; electric characteristics.



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Simpson, Paul Dyer, Assoc. M., Seal Harbor, Me. (Elected Feb. 6, 1907.) (Age 62.) Cons. Engr., John D. Rockefeller, Jr., Mount Desert Island estate, Acadia National Park and Pocantico Hills estate. Refers to H. S. Boardman, G. L. Freeman, N. C. Grover, P. D. Sargent, C. E. Wells.

FROM THE GRADE OF JUNIOR

Bailiff, Norman Lynn, Jun., Kansas City, Mo. (Elected Dec. 9, 1935.) (Age 32.) Designer, The Marley Co. Refers to G. W. Bradshaw, R. B. Houston, W. C. McNown, J. B. Pendleton, F. A. Russell, J. M. Waller.

Bain, Joseph Albert, Jun., Brunswick, Ga. (Elected Nov. 10, 1930.) (Age 32.) Instrumentman, Georgia State Highway Dept. Refers to R. P. Black, J. H. Dowling, H. J. Friedman, F. C. Snow, R. W. Torras.

Beach, George Oliver, Jun., Sioux City, Iowa. (Elected July 23, 1934.) (Age 32.) Asst. Constr. Engr., W. A. Klinger, Inc. Refers to R. A. Caughey, P. D. Cook, R. M. Coomer, T. Russell, L. P. Staman.

Beattie, Kenneth William, Jun., Philadelphia, Pa. (Elected March 14, 1927.) (Age 32.) Research and Test Engr., Baldwin-Southwark Corporation, I. P. Morris Div. Refers to L. M. Davis, H. P. Hammond, S. L. Kerr, O. V. Kruse, D. H. Mattern, W. S. Pardoe.

Borland, Whitney McNair, Jun., Denver, Colo. (Elected Feb. 24, 1931.) (Age 32.) Associate Engr., U. S. Bureau of Reclamation. Refers to D. A. Dedel, C. L. Eckel, E. W. Lane, M. P. O'Brien, L. G. Puls, J. L. Savage, C. P. P. Vetter.

Davidson, Harold Nils, Jun., Chicago, Ill. (Elected Oct. 10, 1927.) (Age 32.) Structural Engr. with F. H. Wells. Refers to L. L. Edlund, A. H. Fuller, N. B. Garver, M. W. Kehart, R. MacMinn.

Durham, Max Judge, Jun., Antioch, Calif. (Elected Aug. 16, 1937.) (Age 32.) Asst. Engr. in field, U. S. Bureau of Reclamation, Delta Div. Refers to G. E. Baker, H. P. Bunger, R. B. Diemer, H. G. Matthews, E. A. Moritz, N. B. Smith, L. P. Sowles, K. H. Talbot.

Gardner, Julius Braden, Jun., Knoxville, Tenn. (Elected March 15, 1937.) (Age 32.) Asst. Hydr. Engr., TVA. Refers to R. T. Brown, D. E. Donley, N. W. Dougherty, Q. B. Graves, J. H. Kimball, E. J. Rutter.

Geyer, John Charles, Jun., Baltimore, Md. (Elected March 27, 1933.) (Age 32.) Associate in Civ. Eng., The Johns Hopkins Univ. Refers to T. F. Comber, Jr., G. M. Fair, A. Haertlein, T. F. Hickerson, J. T. Thompson, A. Wolman.

Horton, Donald Francis, Jun., Boston, Mass. (Elected Oct. 10, 1927.) (Age 32.) Associate Engr. (Civ.), U. S. Engr. Office, being Chf. of Special Studies Sec. with additional duties in Flood Control Div. Refers to J. E. Allen, J. B. Babcock, 3d, C. B. Breed, W. S. Fitzsimons, K. C. Reynolds, G. R. Rich, J. H. Stratton.

Kramer, Robert William, Jun., Columbus, Ohio. (Elected April 30, 1934.) (Age 32.) Asst. Engr., acting as Asst. Project Engr., Ohio State Dept. of Highways. Refers to H. H. Hawley, R. R. Litehiser, C. T. Morris, J. R. Shank, R. N. Waid.

Leap, Clifford Raymond, Jun., Speed, Ind. (Elected March 30, 1931.) (Age 32.) Engr., Louisville Cement Co. Refers to G. H. Allen, G. R. Bickel, O. L. Deweese, J. T. Hallett, W. M. Jarvis, W. R. McIntosh, W. B. Wendt.

Lenehan, George Warden, Jun., Galveston, Tex. (Elected Aug. 12, 1935.) (Age 31.) Associate Engr., U. S. Engr. Office, in charge of flood control survey of Colorado River. Refers to H. Kramer, J. B. Leslie, E. H. Marks, H. A. Sargent, G. R. Schneider, W. R. Spencer, C. P. Wright.

Nixon, Daniel Decatur, Jun., Corpus Christi, Tex. (Elected June 14, 1937.) (Age 29.) Office Engr., Nueces County Eng. Dept., in charge of office work, plans, estimates, etc. Refers to T. W. Bailey, J. S. Fenner, J. T. L. McNew, J. C. McVea, L. W. Roberts, J. G. Rollins, H. P. Stockton, Jr.

Ogram, Arthur Vaughn, Jun., Mobile, Ala. (Elected Dec. 3, 1928.) (Age 32.) Jun. Engr., U. S. Engr. Dept. Refers to C. E. Boesch, H. L. Fisher, W. G. Grove, M. C. Prichard, B. B. Somervell, W. R. Vawter, H. O. Westby.

Peterson, Kenneth Morton, Jun., Roslindale, Mass. (Elected Oct. 1, 1928.) (Age 32.) Asst. to Senior Civ. Engr., Metropolitan District Water Supply Comm. Refers to H. K. Barrows, C. B. Breed, K. R. Kennison, C. C. McCully, W. W. Peabody, F. E. Winsor.

Philleo, Rolland Alson, Jun., Azusa, Calif. (Elected Jan. 13, 1930.) (Age 32.) Structural Designer, Dlouhy & Evans, Structural Engrs., Los Angeles, Calif. Refers to T. C. Combs, H. F. Kjerulf, R. R. Martel, M. U. Serrurier, F. Thomas.

Rose, Howard Dewitt, Jun., Montela, N.Y. (Elected April 7, 1930.) (Age 32.) Eng. Inspector, Grade 4, New York City Board of Water Supply, also Chf. of Survey Party. Refers to H. A. Dibbell, J. A. Guttridge, N. L. Hammond, C. G. Hoerner, Jr., A. N. Mulholland.

Silverman, Isadore Karl, Jun., Denver, Colo. (Elected March 10, 1930.) (Age 31.) Asst. Engr. (acting as Designer in Spillway Div.), Grade 2, U. S. Bureau of Reclamation. Refers to D. A. Dedel, J. W. Howard, K. B. Keener, J. L. Savage, C. M. Spofford, H. Sutherland.

Stansberry, Elmer Frederick, Jun., Dayton, Ohio. (Elected June 10, 1929.) (Age 32.) Engr.-Inspector, City of Dayton, Ohio. Refers to G. F. Baker, C. J. Belz, E. O. Brown, F. J. Cellarius, J. J. Chamberlain, Jr., G. V. Clow, J. F. Hale, B. T. Schad.

Stetina, Henry John, Jun., Pottstown, Pa. (Elected Oct. 10, 1927.) (Age 32.) Structural Engr., Bethlehem Steel Co. Refers to H. L. Bowman, E. L. Durkee, J. Jones, S. J. Leonard, L. L. Lessig, M. G. Littlefield.

Triggs, James Frederick, Jun., Pittsburgh, Pa. (Elected March 15, 1937.) (Age 31.) Chf. Engr., City Planning Comm. Refers to F. Burroughs, A. Diefendorf, W. W. C. Perkins, C. E. Portas, J. M. Rice, M. V. Smirnoff.

Weir, Paul, Jun., Atlanta, Ga. (Elected May 17, 1937.) (Age 32.) With W. Z. Smith, Gen. Mgr., Atlanta Water-Works, as Supt. of Water Purification and Chf. Chemist in charge of water-purification plants. Refers to R. P. Black, L. Cady, C. D. Gibson, F. J. Keis, M. T. Singleton, F. C. Snow, H. F. Wiedeman.

Woodbridge, Cyril James, Jun., Los Angeles, Calif. (Elected Feb. 10, 1930.) (Age 32.) Res. Engr., Bridge Dept., California Div. of Highways. Refers to A. D. Hunting, H. E. McMahon, F. W. Panhorst, S. Roos, R. D. Thorson, R. A. Wagner, D. R. Warren.

The Board of Direction will consider the applications in this list not less than thirty days after date of issue.

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Construction Engineer and Surveyor; Assoc. M. Am. Soc. C.E.; 37; married; C.E., Princeton University; 9 years railroad surveys, construction, electrification, and maintenance; 3 years varied experience in construction, valuation, drafting, etc. Especially qualified for layout and supervision of construction and handling survey parties. Location immaterial. Detailed experience record sent on request. C-416.

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Civil Engineer; M. Am. Soc. C.E.; 50; registered, Tennessee; 26 years with bridge and steel fabricators—through drafting room, design, estimating, and sales, to purchasing agent and plant manager. Engineer army officer, 2 years. Good health and initiative. Capable executive. Best references. Location Southwest only. Available January 1939. C-406.

Attorney at Law; Assoc. M. Am. Soc. C.E.; member, New York State Bar. Graduate personnel administration; 20 years engineering and construction experience; experienced public speaker; at present handling engineering personnel work. Seeks connection with legal department of industrial organization or handling labor relations. Prefers New York State, but will go any place. C-409.

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JUNIOR

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Union College, 1936; M.S.C.E. University of Illinois, 1938; research assistant, University of Illinois, 2 years; several years mechanical drafting; several months office and field experience on highways. Desires position, design and construction of steel and reinforced concrete structures. Location immaterial. Available immediately. C-407.

Civil Engineer; Jun. Am. Soc. C.E.; 32; single; B.S.C.E., Akron University, 1930; 4 years construction factory, water-purification buildings; 18 months highway preliminary surveys as instrumentman; had charge of engineering work on CWA road-grading project; 4 years engineering aide, U. S. Bureau Biological Survey on boundary surveys; available short notice. C-411.

Civil Engineer; Jun. Am. Soc. C.E.; 30; married; B.S.C.E., 1932, and M.S.C.E., 1933, Virginia Polytechnic Institute; Tau Beta Pi. Registered engineer, Virginia. One year foreman and inspector, steel plate and structural fabricating shop. Desires position with construction company or teaching. Employed, but available on reasonable notice. Location immaterial. C-412.

Civil Engineer: Jun. Am. Soc. C.E.; 23; single; B.S.C.E., 1936; 2 years experience as draftsman in engineering department of eastern railroad, working on bridges, buildings, and other structures. Desires position with structural or architectural firm. Location in eastern states preferred. C-413.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; 3 years experience on construction, mainly hydroelectric plants and factory buildings. Desires position with construction firm. Location immaterial. C-414.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.C.E., Columbia University; Theta Tau; high scholastic record; 14 months experience in field on large construction job; 8 months in capacity of chief of party. Desires job with opportunity for advancement to position of responsibility. Will go anywhere. Available immediately. C-415.

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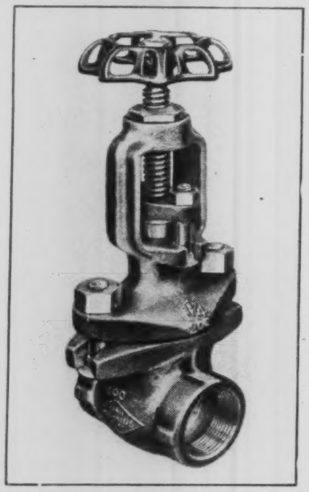
BETHLEHEM STEEL COMPANY

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Stainless Steel Valves

Jenkins Bros., New York, N.Y., introduces to industry corrosion-resisting stainless steel valves, made of Cooper 18-8 S and Cooper 18-8 SMO, each having a carbon content limited to a maximum of .10%. Both are highly resistant to corrosion, but Cooper 18-8 SMO is used under most severe conditions and is particularly adapted to sulphite pulp mills.



These valves are available in seven different styles: solid wedge or double disk gate valves, union bonnet or bolted bonnet regrinding globe or angle valves, and bolted bonnet "Y" valves; all either screwed or flanged, in sizes ½ in. to 3 in.

Bin-Type Retaining Walls

Of special interest to engineers and others faced with the problem of stabilizing or confining earth embankments is the publication of a new 16-page 8½ × 11 bulletin entitled, "Armco Bin-Type Retaining Walls," by the Armco Culvert Mfrs. Assn., Middletown, Ohio.

This type of "cellular" retaining wall is announced as an outstanding improvement over cribbing and monolithic walls. The new feature is the heavy U-shaped column construction, designed to increase strength and stability. Overlapping units —stringers and spacers—are securely bolted to these rigid columns to form a series of connected bins completely closed on all four sides. The new wall is of single-bin construction, and is adapted to low or high walls, to curves and to changes in elevation of the top or base. Other advantages listed are: year-round construction; quick, easy installation by unskilled labor; no curing period; free drainage and 100% salvage value.

A table of sizes, details, and suggested plans are given in the bulletin. A number of uses are illustrated, including slope stabilization, wing walls, restricted right of way, service along lakes and streams where the primary purpose is to prevent erosion or resist wave action. Installation instructions are described and pictured.

Spreader and Leveler

The new D-K Spreader and Finishing Machine for bituminous road construction as well as for re-surfacing work has just been announced by the Shunk Manufacturing Co. of Bucyrus, Ohio.

This new spreader and leveler is drawn by the material trucks which discharge into its hopper. The entire machine is mounted on two wheels in front, which are steered with a hand-controlled lever; and rear tread belts on twin three-wheel tandems. This rear tread mounting is one of the superior features claimed for the D-K. Running entirely on the newly laid surfaces, this rear tread eliminates the possibility of reproducing old depressions or ruts and makes forms of any kind unnecessary, according to the manufacturer's report.

Other features are the oscillating screed powered from the rear wheels, floating forms to regulate the width of the newly spread material, automatic clutch for easy turning, and screw adjustments on strike-off, screed and front wheels. With a capacity of from 1,000 to 1,200 tons per day, the D-K is reported to lay any type of hot or cold mix to any desired thickness, in variable widths from six to ten feet.

Rain Gauge System

The Hildabrand Remote Recording Rain Gauge System is now manufactured and distributed by the Technical Products Co., Inc., 6670 Lexington Ave., Los Angeles, Calif.

This system, which has been in use in the Philippine Islands for several years, provides means of measuring rainfall at a number of remote stations and transmitting these measurements to a central station where they are tabulated and recorded automatically. The system is automatic throughout, requiring no attention other than the initial installation and adjustment and a seasonal inspection. It is useful in all activities where rainfall data are essential, as flood control projects, hydro-electric generator systems, irrigation systems, and meteorology.

Among the outstanding features of the system are: simplicity and ruggedness of construction, low first cost, low maintenance and operation cost, adaptability, accuracy, reliability, and the completeness of data furnished. Prices are dependent on the type of transmission equipment desired.

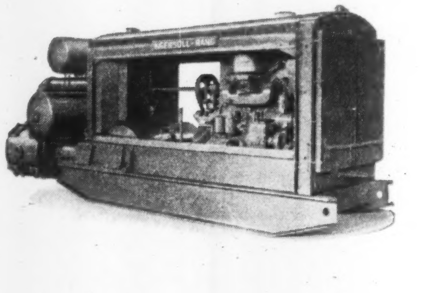
Drafting Machine

Charles Bruning Co., 100 Reade St. New York, N.Y., announces a new civil engineer's drafter, especially designed for the use of map draftsmen and navigators. This drafter provides a full circle protractor, $4^{7}/$ in. in diameter, graduated each one-half degree and numbered with two rows of figures. The inner row of figures for azimuth readings is numbered 0° to 360°, while the outer row is numbered in each quadrant, from 0° to 90°. This machine has gear teeth cut on the edge of the protractor, and is provided with a micrometer adjustment screw. Double vernier reads to single minutes and is flush with the protractor—no parallax. The large magnifier rotates with the vernier and is always in position for reading.

A counter-balanced drafter with all the features of the standard drafter including "Touch Control" (a simplified thumb-regulated button controlling the protractor head) is also available for use on vertical boards. This new machine eliminates the use of track pulleys and ordinary weights.

Semi-Portable and Portable Compressor

A new compressor delivering 425 cu ft of air per minute (actual) at 100 lbs is announced in bulletin 2486 by Ingersoll-Rand, 11 Broadway, New York, N.Y.



Known as the model 425, it is a self-contained compressor plant, available in portable or semi-portable mountings, and employing the same slow-speed, heavy-duty, stationary-type compressor usually purchased for a permanent installation. A four-cylinder, heavy-duty tractor-type engine drives the compressor through simple reduction gears. Either gasoline, gas or oil engines can be furnished. The unit is compact and light and is suited for contracting and oil-field service.

NOTHING TAKES THE PLACE OF THE BALANCE

NOTHING TAKES THE PLACE OF CAST IRON PIPE

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

Recent installation of 30-inch cement-lined cast iron pipe at Washington, D. C. for District of Columbia Water Department.

FOR weighing, nothing since biblical days has supplanted the beam balance with two scale pans. For underground mains the standard material today, as for two centuries, is long-lived, economical cast iron pipe.

If you want proved long life and maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirements but only cast iron pipe meets them all.

Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

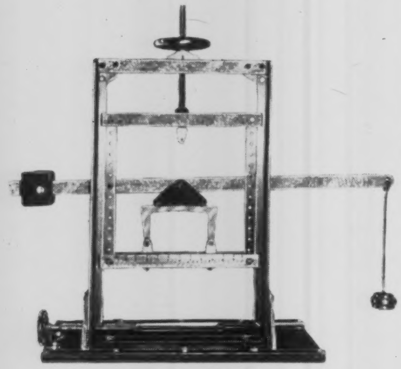
CAST IRON

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

Universal Straining Frame for Photo-Elastic Analysis

Interest in photo-elastic analysis of structural models has grown rapidly in many industrial organizations as well as in university research laboratories during the past few years.

One of the primary elements in the optical train used for this method of analysis is a straining frame for the varied loading of models. Heretofore, most laboratories have built their own straining frames and many of them have certain features in common. A relatively low cost universal type straining frame combining a number of desirable qualities was designed at New York University and is now being made available by Polarizing Instrument Co.



This frame will adapt itself to most of the loading conditions encountered in the analysis of structural models and machine parts subject to two dimensional stress states. The straining unit consists of a rectangular frame which slides vertically within an outer frame sliding horizontally on a steel base plate. As illustrated, the model to be tested is mounted on supports fastened to the inner frame. By means of handwheels, the model may be moved either vertically or horizontally so that the polarized rays will traverse the entire region for which the fringe patterns are to be studied.

The inside frame is made of double bars with a series of holes drilled along the vertical center line of the slide bars. The aluminum alloy lever arm or loading bar, supported on a fulcrum pin inserted in the proper hole, slips between the inside frame bars. With a loading ratio of four to one, a one pound weight on the hanger at the end of the lever arm causes a four pound load on the model. Since a counterweight balances the weight of the bar, loading clevis and hanger, only the applied weights will cause loads upon the model.

The outside frame is a rigid unit supported upon the base plate with stiffening angles and aligned with guide bars so that while the outside frame is free to move horizontally upon the base plate, the entire assembly may be moved as a unit.

This new straining frame is adapted to bending, tension, or compression tests. The figure illustrates a small rigid frame bridge model with loading being applied to cause bending primarily. Note the loading clevis unit which is suspended freely from the lever arm. Loading contact is made by rollers pin-connected to the clevis unit. These rollers may be changed to give a variety of load points; center loading, two-point loading symmetrical with respect to the center line, or unsymmetrical loadings. Attachments are provided as standard accessories for both tension and compression. Special holders and supports may be readily made to meet special needs.

Further details will be supplied by the Polarizing Instrument Co., 8 West 40th St., New York, N.Y.

Relief Door for Dippers

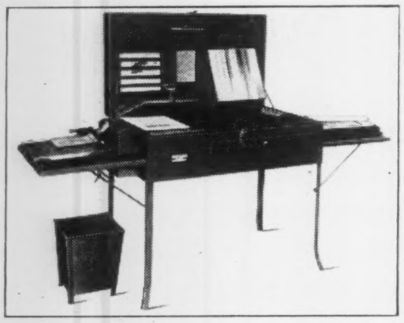
A patented relief door for dredge and power shovel dippers is now being built by the American Manganese Steel Division of The American Brake Shoe & Foundry Co., Chicago Heights, Ill.

This relief door is designed to reduce the resistance encountered when a dipper is lowered into water. The new design permits water to enter through a small auxiliary door in the dipper door, operating in a similar manner to a flap valve. When the dipper is filled with material, the relief door is held closed.

The inside of the dipper door is slightly convex, the relief door forming the center portion of the curve. The outside of the main door has double ribs crossing the relief opening and supporting the relief door when it is closed.

Office Reproduction of Papers

Water-proof, smudge-proof copies, like photostats, may be made in three minutes of letters, documents, blue prints, printed matter, photographs, charts, or anything typed, written, printed, or drawn on a flat surface, by Zenography, "The Modern System of Office Reproduction."



The Zenograph, which occupies about the same space as an ordinary office desk, is manufactured by the Reproduction Equipment Corporation, 11 Broadway, New York, N.Y.

New Type Lantern Globe

A new type of lantern globe, called the "Lite-Gard," has recently been placed on the market by Detroit Metal Products, Inc., Detroit, Mich.

It differs from earlier styles of lantern globes, in that it consists of a steel housing with three glass bulls-eyes. These are equally spaced around its circumference, so as to give perfect visibility in all directions. One of the major advantages claimed for this new type of lantern globe is that it is practically indestructible.

Literature Available

Air Port Construction—The uses of earth moving equipment in this type of work are described in a bulletin entitled, "For Safer Landings." R. G. LeTourneau, Inc., Peoria, Ill.

Aluminum Windows—A ring-bound booklet, "Windows of Alcoa Aluminum," describes windows fabricated by eight leading manufacturers, for use in large buildings and residences. Aluminum Co. of America, Pittsburgh, Penna.

Cathodic Protection—To counteract galvanic action and electrolysis by maintaining a small direct current from ground to structure, a technique known as "cathodic protection" with Rectox Rectifiers, is described in a 4-page illustrated leaflet, No. 27–450. Westinghouse Electric & Mfg. Co., East Pittsburgh, Penna.

Diesel Tractor—The capacities, specifications, and mechanical features of the largest "Caterpillar" Diesel Tractor are grouped in a new, profusely illustrated booklet, No. 4876. Caterpillar Tractor Co., Peoria, Ill.

Highway Lighting—General information on highway lighting and automobile accidents and specific data on Sodium Highway Luminaires and Sodium Vapor Lamps are given in an 8-page illustrated booklet, No. 60–070. Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

Nickel Cast Iron—Specifications for gray cast iron to secure the properties of density, hardness, toughness, wear resistance, greater strength, and improved machinability are given in the revised edition of "Nickel Cast Iron Data," Section 1, Number 1. International Nickel Co., 67 Wall St., New York, N.Y.

Sewage Filter—The advantages of the Magnetite Filter in all methods of sewage treatment, its design features, and records of its performance are given in an interesting illustrated booklet of 12 pages. Filtration Equipment Corporation, 10 E. 40th St., New York, N.Y.

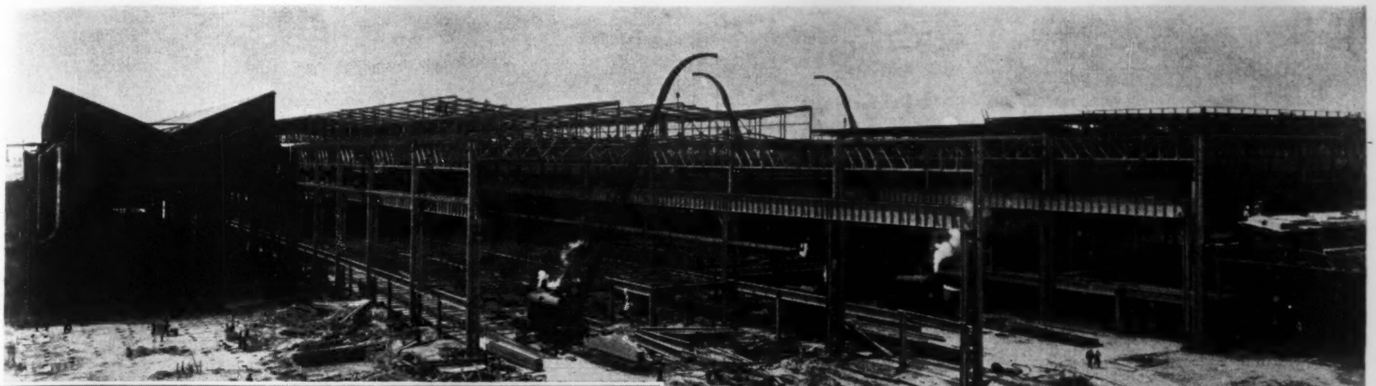
Safety Slings—The announcement of the purchase of the Murray Safety Sling Co., and a brief description of products is given in a 4-page folder. Broderick & Bascom Rope Co., St. Louis, Mo.

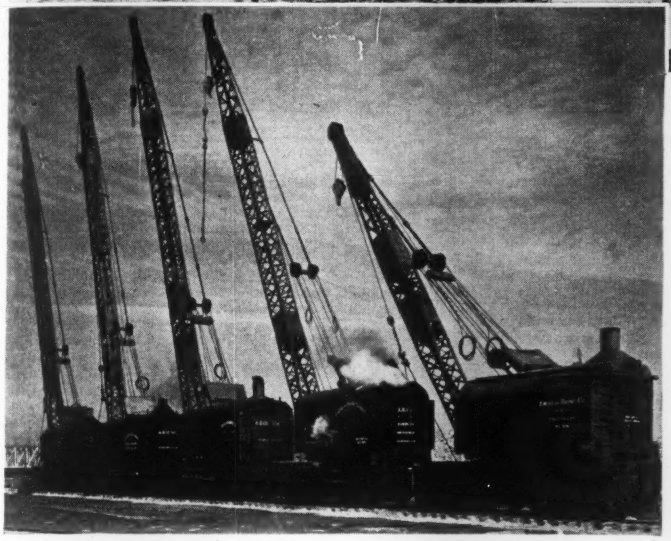
Sewage, Water and Waste—"Through the Camera's Eye" is the title of a booklet which photographically describes typical Dorr Co. equipped plants for sewage, water, and trade waste treatment. Dorr Co., Inc., 570 Lexington Ave., New York, N.Y.

Testing Machines—Bulletin No. 1 catalogs the line of hardness testing equipment, including the new Direct Reading Production Brinnell Machine. Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa.

Timber—The properties of Greenheart and Wallaba Timbers, which do not require creosoting or painting, and the sources of supply for these timbers are given in a 12-page booklet. Greenheart & Wallaba Timber Co., Inc., 52 Vanderbilt Ave., New York, N.Y.

MAKING TIME ON THE *World's Largest Factory Building*





PROGRESS VIEW. Ford Motor Company's new Press Shop comprises 3 major units—at the left a two-aisle building 180 ft. by 292 ft.; at the center, a four-aisle building 240 ft. by 933 ft. at the extreme right, and extending at right angles from the center building, a five-aisle building 340 ft. by 1260 ft. (For the permanent foundations, Carnegie-Illinois Steel Corporation supplied some 24,600 tons of Steel H-Piles, set another world's record—the greatest lineal footage of steel bearing piles, 929,245 lineal feet, ever driven on a single industrial undertaking.)

"RARING TO GO!" A battery of five locomotive cranes, just arrived at the site and ready to set steel. Significant of American Bridge Company's erection facilities, ten locomotive cranes and one crawler crane were used in erecting this huge plant.

● *(Albert Kahn Inc., Architects and Engineers).*

Some 27,500 tons of structural steel fabricated and erected in 190 calendar-days!

WITH approximately 17 acres under roof, the Ford Motor Company's new press shop at the Rouge Plant, Dearborn, Mich., today ranks as the largest factory building in the world.

Three major structures, with minor constructions for contributory facilities, comprise an integrated shop unit engineered for maximum operating efficiency. Because of its extensive steel-framed first floor, an available operating space nearly double the ground floor extent is provided. Construction is characterized by long-span interior column bays with adequate crane service facilities throughout all first floor areas.

The rigorous demands of a 190 calendar-day schedule which governed the fabrication and erection of the huge steel tonnage involved, made the time element of vital importance. Here again American Bridge Company's trained personnel, large plant capacity and ample erecting facilities made it possible to meet the exacting requirements of the Ford project satisfactorily, and ON TIME.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis
Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete Arch, India. Reconstruction of Main Road Bridges, Calcutta, M. R. Atkins and D. H. Remfry. *Instn. Civ. Engrs.—J.*, no. 7, June 1938, pp. 95–123, (discussion) 124–138, supp. plates. Design and construction of seven concrete arch highway bridges replacing old structures near Calcutta, India; maximum span 150 ft; costs; general remarks on bowstring bridges; carrying-power of raft on group of piles.

Crossings for Water Pipe Lines. Suspension Bridge for Water Pipe, R. Sailer. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, pp. 75–77. Construction of catenary suspension bridge, 360 ft in span, to carry 31-in. irrigation pipe line from Pine View Dam across Ogden River Canyon, near Ogden, Utah; structural details of bridge floor and steel pipe line.

Maintenance and Repair. Safeguarding Bridges by Inspection, E. G. Ricketts. *Eng. News-Rec.*, vol. 121, no. 2, July 14, 1938, pp. 51–54. Outline of Oregon state practice in decreasing upkeep costs and insuring public safety by finding and correcting small defects before they become serious; log notes on initial bridge inspection; check list and findings recording results of routine inspection; organization.

Plate Girder, Great Britain. Steel Road Bridge Over London, Midland and Scottish Railway at Spondon. *Engineering*, vol. 145, no. 3778, June 10, 1938, pp. 664–665. Bridge is 260 ft 3 in. long on center line with width of 80 ft between parapet walls; it carries two 20-ft roads and central island as well as two footpaths and two cycle tracks; total weight of steel work is 610 tons, each of five spans consisting of 14 riveted plate girders.

Steel Truss, Failure. Failure of Hasselt Welded Bridge, E. Francois. *Engineer*, vol. 165, no. 4301, June 17, 1938, pp. 675–676; see also editorial comment, pp. 679–680. Account and analysis of cause of accident which occurred Mar. 14, 1938, at Hasselt, Belgium. Similar descriptions previously indexed from various sources.

Steel Truss, Germany. Die Admiral-Graf-Spee-Bruecke ueber den Rhein, G. Holke and H. Sievers. *Bautechnik*, vol. 15, nos. 45 and 47, Oct. 15, 1937, pp. 573–577, and Oct. 29, pp, 605–609. Design and construction of Admiral Graf Spee steel-truss bridge over Rhine River, between Duisburg and Rheinhausen, Germany; total length 753 m; maximum span 256 m; construction of concrete piers and steel erection.

Steel Truss, Ontario. New Highway Bridge Across Nipigon River, E. Smith. *Can. Engr.*, vol. 73, no. 26, Dec. 28, 1937, pp. 5–9. Features of steel truss highway bridge 779 ft long, maximum span 140 ft.

Steel, Welding. New Highway Bridge at Ste. Anne de la Perade, Que., P. C. A. Brault. *Can. Engr.*, vol. 73, no. 20, Nov. 16, 1937, pp. 3–6. Design and construction of longest all-welded bridge superstructure on North American continent; consists of six 107-ft welded deck-plate girder spans, continuous over supports; fabrication of steel.

Suspension, Cables. Island of Orleans Suspension Bridge; Pre-stressing and Erection, D. B. Armstrong. *Eng. J.*, vol. 21, no. 7, July 1938, pp. 315–323, (discussion) 323–325. Principles involved, and methods employed in pre-stressing cable strands and suspender ropes for Island of Orleans bridge, measuring 5,840 ft between abutments; pre-stressing plant; anchorage movement; cutting and socketing; temperature study on 2,500-ft bridge strand; catwalks; cable wrapping. Before Eng. Inst. Canada.

BUILDINGS

Air Conditioning. Air Conditioning and Mechanical Equipment for Modern Library Building, A. S. Crocker and R. E. Cherne. *Refrig. Eng.*, vol. 36, no. 1, July 1938, pp. 13–15. Installation at Rundel Memorial Buildings for Rochester Public Library described; heating is by means of 17,000 sq ft of cast iron direct radiation; all air-conditioning equipment is located in apparatus room on fourth floor level; vertical zoning used.

Air Conditioning. U. of C. Air Conditions New Building, L. R. Flook. *Heating, Piping & Air Conditioning*, vol. 10, no. 7, July 1938, pp. 433–435. Design and construction of Public Administration Building at University of Chicago; features of particular interest are design of structural framing to provide space for air ducts, and provisions made in heating and air-conditioning layout to allow for flexibility of partitions.

Air Conditioning, Sun Load Effect. How to Reduce Heat Loads Due to Sunlight on Roofs, J. F. Kern, Jr. *Heating & Vent.*, vol. 35, no. 7, July 1938, pp. 33–36. Theory of solar radiation reviewed, and various methods of reducing sun load discussed; some test data and possible reductions that may be expected are reported.

Building Materials, Glass. How Glass Blocks Are Made, J. A. Lee. *Chem. & Met. Eng.*, vol. 45, no. 4, Apr. 1938, pp. 184–185. Notes on methods employed by Pittsburgh Corning Corporation for production of glass blocks; plant is composed of raw material storage silos, mixing building, compressor house, and main processing building; two styles of glass blocks are being produced—Argus and Decora—each pattern in three sizes.

Construction. Old and New Building Methods, R. W. Abbett. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, pp. 24–25. Use of ancient and modern practices in construction of concrete building of Faculty of Medicine of University of Paris, France; foundation construction; concrete plant.

Department Stores, Montreal. Heavy Steel Framing in Kresge's Store in Montreal, L. H. Ingersoll. *Can. Engr.*, vol. 73, no. 21, Nov. 23, 1937, pp. 5–11. Design features of heavy steel frame of 5-story building occupying area of 53 by 121 ft; compound columns; loads and stresses of typical truss; truss details; framing for escalator clearance; hanger and long columns bracing.

Design. Lateral Resistance of Buildings, A. Floris. *Eng. News-Rec.*, vol. 121, no. 2, July 14, 1938, p. 59. Mathematical discussion of theory based upon observed earthquake failures, assuming independent column action in each story if floors are rigid; column moments resulting from lateral forces on building with rigid floors.

Motion Picture Theaters. Report of Projection Practice Committee. *Soc. Motion Picture Engrs.—J.*, vol. 30, no. 6, June 1938, pp. 636–649, (discussion) 649–650. Survey of motion picture theaters for purpose of determining existing conditions under which motion pictures are presented; survey covers approximately 600 theaters, and is shown to be fairly representative of entire industry; data presented are to form basis of analysis leading to determination of criteria for proper motion picture theater design.

Moving. Store Skewed in Moving. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, pp. 86–87. Method of moving 9-story building, in Hartford, Conn., for distance of 112 ft, simultaneously skewing it to fit new location; no interruption of services or inconvenience to occupants occurred during moving.

Soundproofing. Insulation of Air-Borne Sound, C. J. Morreau. *Acoustical Soc. America—J.*, vol. 10, no. 1, July 1938, pp. 45–49. Application of laboratory results to practical building problems.

CITY AND REGIONAL PLANNING

Decentralization. Municipal and Industrial Planning, A. Lilienberg. *Mech. World*, vol. 104, no. 2693, Aug. 12, 1938, pp. 157–158. Labor, material, and site as affected by present tendency towards decentralization. Before Int. Eng. Congress.

Housing, United States. Greenbelt, Maryland: Federally Planned Community, C. Larson. *Nat. Mun. Rev.*, vol. 27, no. 8, Aug. 1938, pp. 413–420. Planning, development, and organization of federal housing project in Maryland covering 3,600 acres and occupied by about 1,000 families; houses and town plan; utilities and public buildings; rentals and tenants; manager; charter; finances; civic activities.

United States. National Conference on Planning, G. H. Herrold. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, pp. 85–86. Proceedings of National Conference on Planning held in Minneapolis and St. Paul, June 20–22, 1938, including abstracts of papers and discussions on traffic engineering and national planning.

CONCRETE

Chimneys. Reinforced Concrete Chimneys, C. P. Taylor and L. Turner. *Concrete & Constr. Eng.*, vol. 33, nos. 1, 3, and 6, Jan. 1938, pp. 3–14; Mar., pp. 145–164; and June, pp. 301–305. Jan: Historical review and descriptions of chimneys built in England illustrating developments and difficulties encountered. Mar.: Calculation of wind pressure on chimneys with special reference to British meteorological conditions; alignment charts; stresses due to wind and weight. June: Analysis of stresses arising from difference in temperature of inside and outside of shell. (To be continued.)

Construction, Joints. Ausbildung Wasserdichter Dehnungsfugen, Press. *Bauingenieur*, vol. 19, no. 1/2, Jan. 7, 1938, pp. 4–5. Design of waterproof expansion joints for concrete linings of canals and reservoirs.

Curing. Columbia Manual of Concrete Curing. Barberton (Ohio), Columbia Alkali Corportion, 1937, 52 pp. Columbia Alkali Corporation publication on curing of concrete with calcium chloride; A.S.T.M. specifications for calcium chloride; admixture method; cold weather curing; surface method; volume change and surface hardness of cured concrete; preparation of subgrade.

Disintegration. Zur Kenntnis der Einwirkung sulfathaltiger Waesser auf Zementmoertel und Beton, H. Ditz and F. Ullrich. *Korrosion u. Metallschutz*, vol. 14, no. 5, May 1938, pp. 154–165. Effect of sulfate bearing water on cement mortar and concrete; results of investigations of effect of sulfate solutions showed that sulfate could be completely precipitated from solutions in cement mortar, so that even water with relatively low content of sulfate, can have injurious effect. Bibliography.

Ready-Mixed Plants, Washington. Ready-Mix Plant Designed to Eliminate Mechanical Handling. *Pit & Quarry*, vol. 31 no. 1, July 1938, p. 90. Brief comment on plant of H. O. Sieffert Co, Everett, Wash.; plant was built at end of spur track beside street viaduct; elevation of viaduct controls height of bins as sand and gravel are discharged from trucks at street level directly into them; batching floor is at elevation making possible transfer of sacked cement direct from cars.

Reinforcement. Standard Specifications for Reinforcing Materials for Concrete. G30—1938: Billet-Steel Concrete Reinforcing Bars; G31—1938: Rail-Steel Concrete Reinforcing Bars (Third Edition); G32—1938: Cold-Drawn Steel Wire for Concrete Reinforcement (Third Edition); G45—1938: Fabricated Steel Bar or Rod Mats for Concrete Reinforcement; G48—1938: Welded Steel Wire Fabric for Concrete Reinforcement. *Can. Eng. Standards Assn.—Standard Specification*, G30, G31, G32, G45, and G46—1938, 31 pp., 75 cents.

Reservoirs. Vibrated Concrete in Reservoir Construction. *Concrete & Constr. Eng.*, vol. 33,

THE TIGER'S ON THE JOB

. . . building the World of Tomorrow

AMERICAN STEEL & WIRE COMPANY
AMERICAN TIGER BRAND WIRE ROPE

GETTING THE "World of Tomorrow" ready for millions who will visit New York in 1939 is one of the year's biggest jobs. Wherever such jobs are being done, you will always find American Steel & Wire Company products playing a leading part because of their economy and dependability.

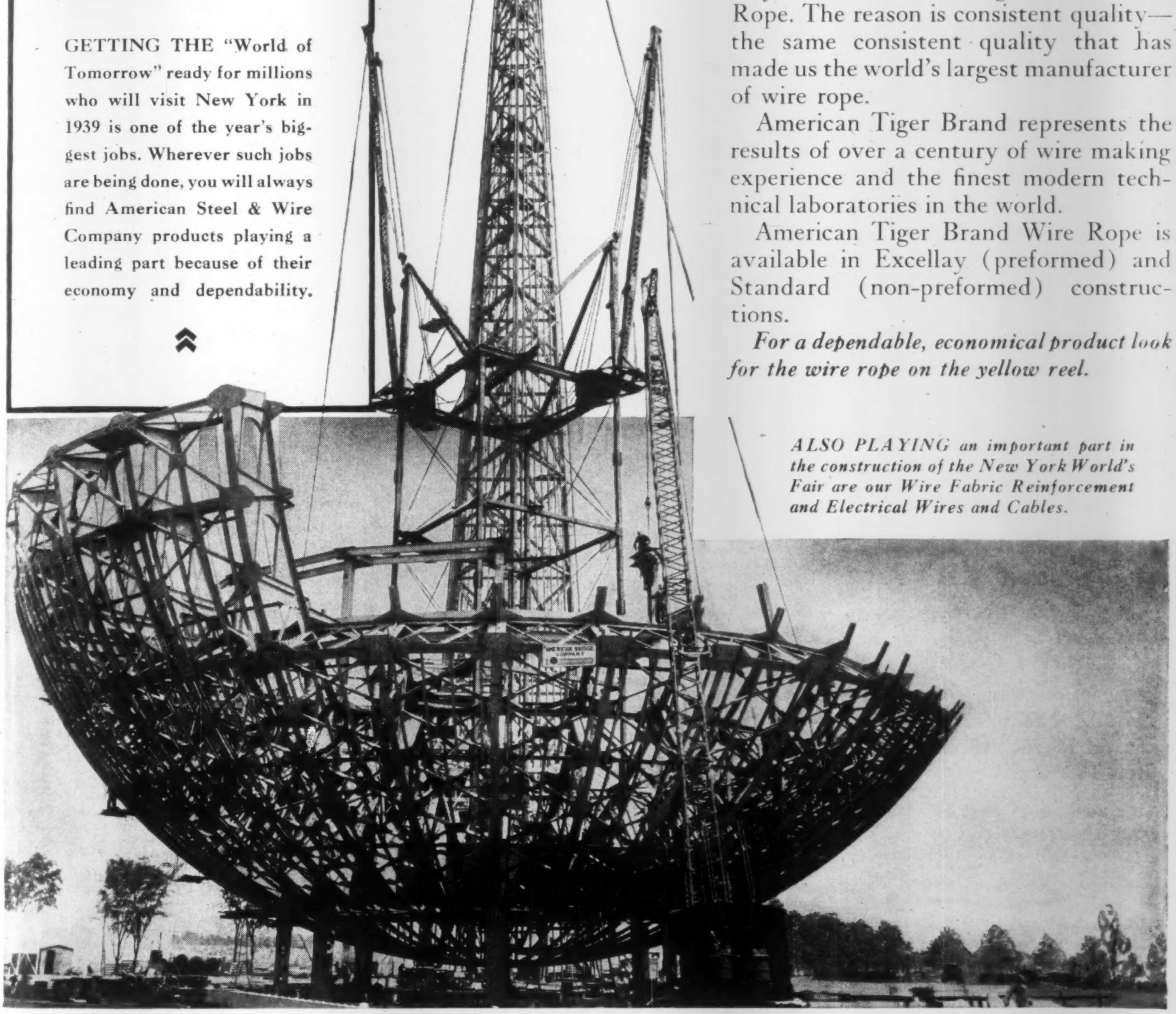
WHEREVER important construction work is being done you'll always find American Tiger Brand Wire Rope. The reason is consistent quality—the same consistent quality that has made us the world's largest manufacturer of wire rope.

American Tiger Brand represents the results of over a century of wire making experience and the finest modern technical laboratories in the world.

American Tiger Brand Wire Rope is available in Excellay (preformed) and Standard (non-preformed) constructions.

For a dependable, economical product look for the wire rope on the yellow reel.

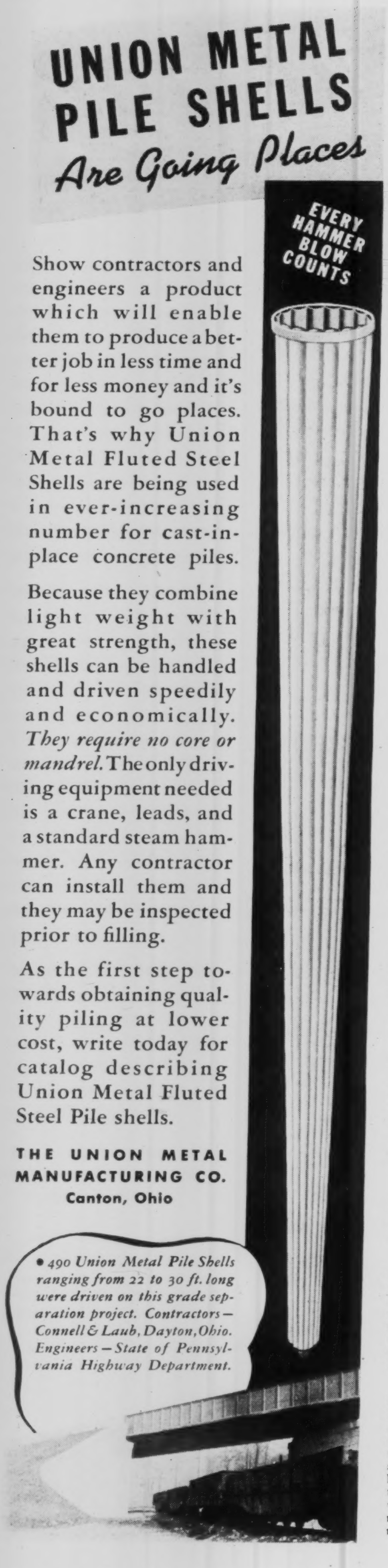
ALSO PLAYING an important part in the construction of the New York World's Fair are our Wire Fabric Reinforcement and Electrical Wires and Cables.



AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York
COLUMBIA STEEL COMPANY, *San Francisco*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL



UNION METAL PILE SHELLS
Are Going Places

Show contractors and engineers a product which will enable them to produce a better job in less time and for less money and it's bound to go places. That's why Union Metal Fluted Steel Shells are being used in ever-increasing number for cast-in-place concrete piles.

Because they combine light weight with great strength, these shells can be handled and driven speedily and economically. *They require no core or mandrel.* The only driving equipment needed is a crane, leads, and a standard steam hammer. Any contractor can install them and they may be inspected prior to filling.

As the first step towards obtaining quality piling at lower cost, write today for catalog describing Union Metal Fluted Steel Pile shells.

THE UNION METAL MANUFACTURING CO.
Canton, Ohio

• 490 Union Metal Pile Shells ranging from 22 to 30 ft. long were driven on this grade separation project. Contractors—Connell & Laub, Dayton, Ohio. Engineers—State of Pennsylvania Highway Department.

no. 7, July 1938, pp. 374–376. Use of vibrators in construction of reinforced concrete reservoir walls consisting of 9 to 6-in. slabs between counterforts at 8-ft centers; advantages of vibration.

RESERVOIRS, LINING. Relining Elevated Storage Reservoir with Gunite, R. W. Esty. *New England Water Works Assn.—J.*, vol. 52, no. 1, Mar. 1938, pp. 30–57. History of Wills Hill water distribution reservoir at Danvers, Mass., 125 ft in diameter, with capacity of 700,000 gal; details of gunite relining operations; costs.

SPECIFICATIONS. Report of Committee C-9 on Concrete and Concrete Aggregates. *Am. Soc. Testing Matls.—Preprint No. 60*, mtg. June 27–July 1, 1938, 30 pp. Recommendations affecting standards; Stress-Strain Characteristics of Mortars and Concretes, H. J. Gilkey and G. Murphy; test for clay lumps in aggregates, abrasion of coarse aggregate, unit weight of aggregate, yield of concrete, freezing and thawing of aggregates, and sieve analysis of aggregates.

WOOD REINFORCEMENT. Concrete Reinforced with Timber, M. I. Ewdokimow-Rokotovsky. *Concrete & Constr. Eng.*, vol. 33, no. 6, June 1938, pp. 325–326. Abstract of paper previously indexed from *Beton u. Eisen*, Oct. 20, 1937.

DAMS

CONCRETE, INDIA. Kut Barrage. *Engineering*, vol. 145, no. 3777, June 3, 1938, pp. 619–620, supp. plate. Scheme being carried out for Iraq Ministry of Economics and Communications; barrage being built across river Tigris, will be 500 m long and is being constructed on floor of mass concrete $82^1/_2$ m wide, with auxiliary block apron 15 m wide; it will contain 56 openings, each 6 m wide, and will be controlled by single sluice gates; main barrage and lock are being constructed in steel pile sudds or cofferdams.

CONCRETE, MAINTENANCE AND REPAIR. Closing Sluiceways Under Head, A. B. MacMillan. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, p. 19. Method of closing sluiceways used in replacing 200-ft middle section of 450-ft concrete dam breached by Connecticut flood of 1936; steel beam grill sunk and closed with plank needles to reduce flow, for placing tight plank gate.

EARTH, RIPRAP. Precast Concrete Riprap for Kingsley Dam, D. A. Buzzell. *Eng. News-Rec.*, vol. 121, no. 2, July 14, 1938, pp. 54–55. Description of new type of reinforced concrete riprap specified as alternate for protection of slopes of earth fill of Kingsley Dam (formerly Keystone), Nebraska; 160 ft high and 2 miles long.

HYDRAULIC FILL, MONTANA. Review of Construction Progress and Closure Method at Fort Peck Dam, R. Lee. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 215–217. Outline of operations carried out to turn Missouri River through four diversion tunnels; car loads of gravel and rock dumped into final gap at rate of one per minute; quarry operations; spillway; dredging progress.

MULTIPLE ARCH, ARIZONA. Highest Multiple Arch Dam. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, pp. 13–18. Design and construction of Bartlett Dam, rising to record-breaking height of 287 ft, to store flood waters of Verde River for Salt River Irrigation Project in Arizona; construction plan; contractor's plant; concreting; forms.

SOILS. Study of Physical Characteristics of Soils—with Special Reference to Earth Structures, D. M. Burmister. *Columbia Univ.—Civ. Eng. Research Lab.—Bul. No. 6*, June 1938, 59 pp., 40 cents. Study of physical factors of soils; evaluation of grading analysis of soils, based on physical as well as simplified statistical considerations; capillary tendencies of granular materials; applications to hydraulic and earth-fill dams; compaction tests.

SPILLWAYS. Spillway Gates at Pickwick Landing Dam. *Engineer*, vol. 165, no. 4300, June 10, 1938, p. 654. Brief illustrated description of steel gates being installed in dam on Tennessee River.

STEEL. Principal Considerations in Design of Steel Dams, O. E. Hovey. *Can. Engr.*, vol. 73, nos. 8 and 11, Aug. 24, 1937, pp. 5–8 and 10, and Sept. 14, p. 8. Chief features of some outstanding structures; suitability of steel for dams; conditions that must be observed when designing framed steel dams; description of El Vado Dam having maximum height of 170 ft. Before Am. Inst. Steel Construction.

WEIRS, DESIGN. Design of Weirs on Permeable Foundations, A. N. Khosla, N. K. Bose, and E. M. Taylor. *India Central Board Irrigation—Publ. No. 12*, Sept. 1, 1936, 178 pp., supp. plates. Development of subsoil hydraulics for design of weirs on permeable foundations; theory of seepage flow; potential law; verification of potential law by means of models; electric analogy method; temperature effect on models; mathematics of weir design; exit gradients; standard forms; rules and principles of design; design of weirs in relation to surface flow.

FLOOD CONTROL

DETENTION RESERVOIRS. Hochwasser-Abwehr durch gestaffelte Rueckhaltebecken, R. Winkel. *Bautechnik*, vol. 15, no. 42, Sept. 24, 1937, pp. 546–548. Theoretical discussion of flood control by means of series of detention reservoirs.

PROTECTING CITIES AND TOWNS. Protecting The Dalles from Bonneville Reservoir Rise. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 236–238. Construction of levee $2^1/_4$ miles long and extensive changes in sewerage system required at Oregon town as result of 23-ft rise in pool behind dam on Columbia River.

RIVER CONTROL. River Control and Flood Prevention, S. D. Foote. *Can. Engr.*, vol. 73, nos. 23 and 25, Dec. 7, 1937, pp. 7–13, and Dec. 21, pp. 9–13. Dec. 7: Calculating runoff from watersheds by unit graph method; flood control methods; runoff resulting from sudden thaw. Dec. 21: Sedimentation process; plans for control of Grand River, Ontario.

FOUNDATIONS

COFFERDAMS. Cheap Little Cofferdam, W. B. Kane. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, p. 94. Construction of small cofferdam for concrete bent at cost of $85, allowing for salvage.

DESIGN. Étude de la fondation rectiligne et de la fondation circulaire, Bonneau. *Annales des Ponts et Chaussees*, vol. 108, no. 4, Apr. 1938, pp. 497–553. Comparative theoretical mathematical discussion of design of rectilinear and circular foundations.

DRAINAGE. Record Well-Point Installation Used to Drain Exposition Site. *Western Construction News*, vol. 13, no. 6, June 1938, pp. 209–212. Installation of well points to lower water level on about 300 acres of island site for Golden Gate International Exposition involving use of 300 points and 25 pumps resulted in removing more than 600 acre-ft of salt water; spacing of well points; equipment in use; pumping results; leaching operations.

EARTH PRESSURE. Soil Load on Buried Plates, W. Z. Lidicker. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, pp. 82–83. Report on tests by U. S. Engineer Office, St. Paul, Minn., for determination of pressures that sand fill would exert as it settled past tie rods, between sheet-pile walls holding earthfill in abutments of Mississippi River Dam No 3.

PILE DRIVING. Investigation of Stresses in Reinforced Concrete Piles During Driving, W. H. Glanville, G. Grime, E. N. Fox, and W. W. Davies. (Great Britain) Dept. Sci. & Indus. Research—Bldg. Research—Tech. Paper No. 20, 1938, 111 pp., 3s. net. Charts for determination of maximum compressive stress at head and foot of pile; measurement of stress and set; peak stress indicator; strains in test piles; tests of packing materials; recommendations as to design and manufacture of concrete piles; handling stresses; flexural vibrations.

PILES, DRIVING. Driving Reinforced Concrete Piles. *Engineer*, vol. 165, no. 4296, May 13, 1938, p. 550. Review of report issued by Department of Scientific and Industrial Research, published by H. M. Stationery Office, price 3s. net, on investigation into causes of failure and methods for preventing damage in concrete piles during driving.

PILES, STEEL. Belastungsproben an Stahlpfaehlen und deren Anwendung bei der Erweiterung des Dortmund-Ems-Kanals, Arens and Roehnisch. *Bautechnik*, vol. 15, nos. 45 and 49, Oct. 15, 1937, pp. 586–590, and Nov. 12, pp. 643–646. Results of tests of double interlocked steel sheet piles used in extension of Dortmund-Ems canal, Germany, particularly in connection with bridge construction.

SOILS. l'Étude du Sol et des Fondations, Mayer. *Société Royale Belge des Ingénieurs et des Industriels*, no. 5, May 1938, pp. 431–448. Review of principles of soil physics including features of experimental equipment; application of theoretical principles to practical problems in construction of dams, canal linings, etc.

SUBWAY CONSTRUCTION. Unterfahrung des Verwaltungsgebaeudes etc., Kraemer. *Bautechnik*, vol. 15, nos. 42 and 43, Sept. 24, 1937, pp. 541–546, and Oct. 1, pp. 553–555. Description of underpinning and other foundation work in connection with construction of North-South line of new Berlin subway.

HYDRAULIC ENGINEERING

SURGE TANKS, DESIGN. Zur Berechnung des Wasserschlosses, R. Winkel. *Bautechnik*, vol. 15, no. 43, Oct. 1, 1937, p. 556. Theoretical mathematical discussion of hydraulic design of surge tanks.

WEIRS, DESIGN. Design of Weirs on Permeable Foundations, A. N. Khosla, N. K. Bose, and E. M. Taylor. *India Central Board Irrigation—Publ.* No. 12, Sept. 1, 1936, 178 pp., supp. plates. Development of subsoil hydraulics for design of weirs on permeable foundations; theory of seepage flow; potential law; verification of potential law by means of models; electric analogy method; temperature effect on

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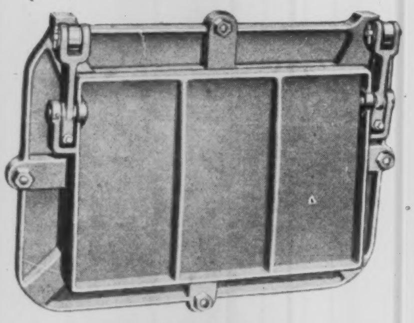

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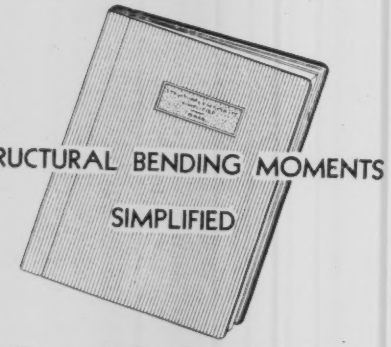

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HYDROLOGY AND METEOROLOGY

Erosion, Control. Beavers Used on Streams for Reclamation Work. *Eng. News-Rec.*, vol. 121, no. 5, Aug. 4, 1938, p. 152. Beavers imported by Division of Grazing of U. S. Department of Interior for construction of dams to check soil erosion and store water supplies; cost of placing beaver averages $5, and estimated value of work done by animal is about $300.

Erosion, Control. Stream Bank Protection, I. L. Saveson and V. Overholt. *Agric. Eng.*, vol. 18, no. 11, Nov. 1937, pp. 489–491. Results of experimental study, by Ohio State University and Soil Conservation Service, including tests of hydraulic models for investigation of methods of control of stream-bank cutting by means of special reflectors and plantings. Before Am. Soc. Agric. Engrs.

Flow of Water, Underground. Le mouvement de l'eau dans le sol, A. Vibert. *Génie Civil*, vol. 113, no. 2916, July 2, 1938, pp. 7–11. Theoretical mathematical analysis of flow of water through underground formations.

Magnetic Charts. United States Magnetic Tables and Magnetic Charts for 1935, H. H. Howe and D. G. Knapp. *U. S. Coast & Geodetic Survey—Serial* No. 602, 1938, 161 pp., supp. maps. 20 cents. Revised collected results of magnetic observations in United States; derivation of secular-change tables; construction of magnetic charts; lines of equal annual change.

Weather Forecasting. Weather Forecasting, C. F. Brooks. *Boston Soc. Civ. Engrs.—J.*, vol. 24, no. 4, Oct. 1937, pp. 305–322. Review of weather forecasting methods of U. S. Weather Bureau; mountain stations; cloud observations; balloons, airplanes, radio-meteorographs; air mass analysis; long-range forecasting.

IRRIGATION

India. Swab River Canal. *Engineer*, vol. 165, no. 4301, June 17, 1938, pp. 684–685. Description of project consisting of weir 700 ft long across river at Amandra, main canal 13 miles long, and branches and distributaries aggregating 553 miles; construction of aqueducts, siphons, culverts, etc.; details of tunnel excavated in hard muscovite granite, and Malakand hydroelectric scheme with transmission line 4½ miles in length.

Overhead. Irrigation by Sprinkling, J. E. Christiansen. *Agric. Eng.*, vol. 18, no. 12, Dec. 1937, pp. 533–538. Report on University of California experimental study of irrigation sprinkling with portable systems; types of portable sprinkler-pipe couplings; sprinkler patterns; effect of wind on distribution of water from sprinkler; evaporation losses; pressure losses, hydraulic characteristics; arrangement of portable sprinkler system in orchard. Before Am. Soc. Agric. Engrs.

Pumping Plants, Australia. Merbein Irrigation Pumping Station, Victoria, Australia. *Engineering*, vol. 145, no. 3778, June 10, 1938, pp. 646–647. Original plant modernized in three stages by connecting Merbein with pumping station at Red Cliffs 13½ miles away, by means of electric transmission line; first stage of conversion begun in 1937 by installing 1,250-kva Metropolitan Vickers turbo-alternator at Red Cliffs generating three-phase current at 6,600 v and frequency of 50 cycles; Metropolitan Vickers slip ring induction motor is direct coupled to 30-in./33-in. centrifugal pump.

Sewage. Bau einer Gross-Feldberegnungsanlage zur landwirtschaftlichen Verwertung gewerblicher Abwaesser in Konstadt (O.-S.), Zwinkau. *Bautechnik*, vol. 15, no. 47, Oct. 29, 1937, pp. 601–605. Design, construction, and operation of overhead sprinkling system for irrigation of 100 acres of hemp fields, near Konstadt, Germany, with effluent of sewage disposal plant; cost data; effect of sewage irrigation on quality and yield of crops.

LAND RECLAMATION AND DRAINAGE

Culverts, Design. Design of Box Culverts, J. Nayler. *Concrete & Constr. Eng.*, vol. 33, no. 6, June 1938, pp. 314–317. Construction of set of curves from which moments in reinforced concrete box culvert can be obtained for usual types of load which occur in practice.

Embankments. Drainage System Solves Serious Bridge Filling Problem. *Ry. Eng. & Maintenance*, vol 34, no. 7, July 1938, pp. 424–426. How Chicago Burlington and Quincy Railroad installed subsoil drainage to overcome unstable soil conditions in connection with bridge-filling project near Fairfield, Iowa.

MATERIALS TESTING

Building Materials, Research. Building and Road Research in Great Britain, R. E. Stradling. *Chem. Age*, vol. 39, no. 993, July 9, 1938, pp. 33–34. Chemical and physico-chemical testing; weathering of building stones; porous building materials; limes and plasters; fire-resisting tests. Before Road & Bldg. Mat Group, Ottawa.

Concrete Aggregates. Nouvelles recherch sur la forme des éléments inertes des bétons, Feret. *Annales de l'Institut Technique du Batiment et des Travaux Publics*, vol. 3, no. 3, May June, 1938, pp. 31–47. Experimental study of effect of shape of crushed rock and gravel aggregates on strength and other properties of concrete; original method for quantitative characterization of shape of coarse aggregates.

Soils. 10 Jahre Baugrunduntersuchungen bei den daenischen Staatsbahnen, O. Godskesen. *Bautechnik*, vol. 15, no. 44, Oct. 8, 1937, pp. 568–570. Review of soil-testing apparatus and methods developed by state railroads of Denmark during the past 10 years.

PORTS AND MARITIME STRUCTURES

Cargo Handling. Erz- und Kohlenverladeanlagen im Danziger Hafen, A. Klotzky. *Bautechnik*, vol. 15, no. 44, Oct. 8, 1937, pp. 561–565. Description of port facilities of Danzig for loading and unloading of ore and coal.

ROADS AND STREETS

Asphalt. Manufacture and Use of Asphalts for Low-Cost Road Construction, J. E. Easterbrook and R. K. Stratford. *Can. Engr.*, vol. 73, no. 24, Dec. 14, 1937, pp. 5–10. Review of recent improvements in asphalt-refining methods and experimentation; laboratory developments; methods of manufacture; application to low-cost road construction; developments now in progress.

Design. Present Trend of Highway Design, H. W. Griffin. *Can. Engr.*, vol. 73, nos. 15 and 18, Oct. 12, 1937, pp. 13–15, and Nov. 2, pp. 11–12. Oct. 12: Important factors that must be considered in design and use of highways; horizontal curvature; design of shoulders; joints in concrete pavements; smooth surfaces; designing intersections. Nov. 2: Increase in motor traffic; safe driving; trend of highway accidents. Before Can. Good Roads Assn.

Embankments. Stabilizing Earth Fills with Rock. E. W. Vaughan. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, pp. 27–28. Study of rock blankets for holding fill slopes steeper than natural slope of earth, in relocation of highways by Tennessee Valley Authority in Guntersville Reservoir area in northern Alabama; effect of rock on slide slope of soils for various frictional resistances.

Highway Systems, Belgium. Les routes de l'état en Belgique, A. Devallee. *Annales des Travaux Publics de Belgique*, vol. 39, no. 2, Apr. 1938, pp. 283–314. Engineering and statistical review of present status of highway systems of Belgium, with special reference to new automobile highways; roadway standards; proposed extensions of system.

Highway Systems, Germany. Germany's New Motor Highways, B. Wehner. *S. Wales Inst. Engrs.—Proc.*, vol. 53, no. 3, Dec. 23, 1937, pp. 193–207 and map. New superhighways planned independently of existing traffic and designed for possible speed of 100 miles per hr in flat country and 87.5 miles per hr in hilly country; in general, minimum curve radius 1,100 yd and steepest gradient 6 in 100; general data on organization and construction.

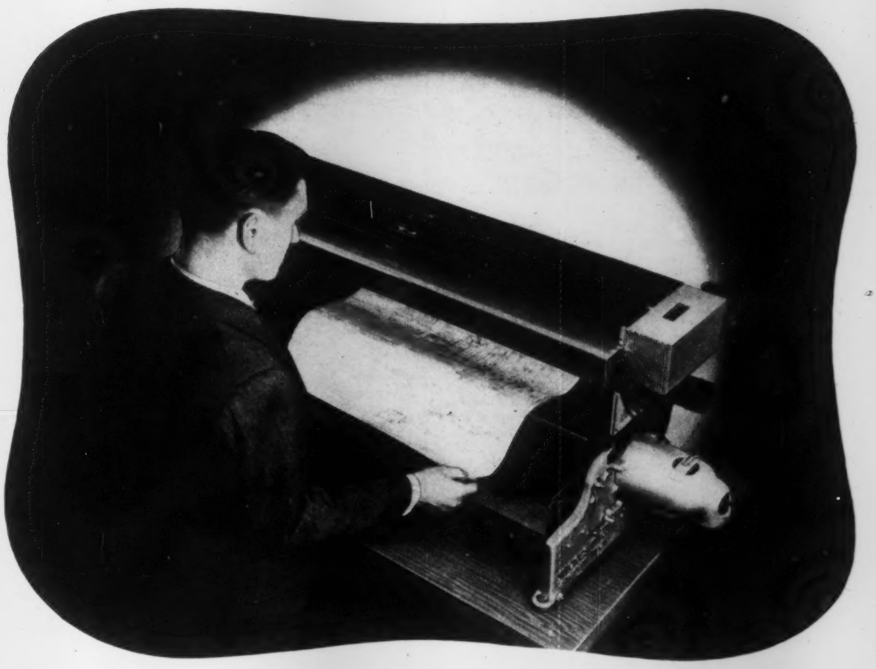
Maintenance and Repair. Screed for Placing Measured Windrows, G. S. Covert, Jr. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, p. 33. Description of screed developed by Mississippi State Highway Department for depositing road-surfacing aggregate in measured windrows, to secure required thickness of treated mat in road mix construction.

Maryland. Notable Dual Road Completed, N. L. Smith. *Eng. News-Rec.*, vol. 121, no. 2, July 14, 1938, pp. 45–49. Design and construction of 27-mile four-lane divided highway from Baltimore to Havre de Grace, Maryland; problem of settlement of swamp fills solved by blasting; water problems; quantities and costs; future extension to Delaware state line.

Parkways. First Parkway for Los Angeles. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, pp. 79–82. Design and construction of new grade-separated, divided-lane route which will extend 6 miles up Arroyo Seco from Figueroa St. viaduct in Los Angeles to Pasadena; details of deep, long-span steel girders of Figueroa St. viaduct; pavement cross-section of Arroyo Seco Parkway; make-up of T-flange and double-web girders.

Railroad Crossings, Gates. Semi-Automatic Gates on Milwaukee. *Ry. Signaling*, vol. 31, no. 7, July 1938, pp. 409–411. Installation completed by Chicago, Milwaukee, St. Paul & Pacific Railroad on Chicago Terminal division at Narragansett Avenue in Chicago, including flashing lights and bells, is operated automatically by through train movements and manually for switching movements on any track.

Railroad Crossings, Gates. Short-Arm Gates Added to Flashing-Light Crossing Signals. *Ry. Age*, vol. 105, no. 3, July 16, 1938, pp. 109–110. Automatically controlled crossing gates added to existing signals at three crossings in



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Railroad Signals and Signaling. Signaling and Spring Switches on Southern. *Ry. Signaling*, vol. 31, no. 7, July 1938, pp. 398–402. Signaling installation which includes centralized traffic control on 4 miles of single-track line between Beverly, Tenn., and Sharps Gap, and automatic block signaling between Sharps Gap and Clinton, 18.6 miles, completed by Southern Railway; spring switches installed at 17 switches at passing tracks, end of double track, and junctions; diagram given.

Roadside Improvement. Roadside Development. *Engineering*, vol. 145, no. 3776, May 27, 1938, pp. 589–590. Review of special report at annual meeting of U. S. Highway Research Board.

Soil Cement. How to Process Soil-Cement Roads, F. T. Sheets and M. D. Catton. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, pp. 20–24. Portland Cement Association recommendations as to operations, equipment, and field organization based on experience on nearly 30 soil-cement road jobs; personnel requirements; mechanical mixers; mixing soil and cement with field cultivators; subgrade treatments with cement; test results on raw soil and soil-cement mixtures.

Southampton. Southampton Docks Extension, M. G. J. McHaffie. *Instn. Civ. Engrs.—J.*, no. 7, June 1938, pp. 184–219, (discussion) 220–236, supp. plate. Description of works recently carried out by Southern Railway Company at Southampton in West Bay of river Test; dredging and reclamation; quay-wall; King George V graving dock; culverts and pumping station equipment; condensing water culverts and stormwater drainage.

Swamps. Neue Erfahrungen ueber Strassenbau im Moor, L. Casagrande and P. Siedek. *Bautechnik*, vol. 15, no. 48, Nov. 5, 1938, pp. 618–621. Use of blasting for settling of highway fills, up to 3 m in height, across swampy ground in Germany.

Traffic Control. Segregation of Various Classes of Traffic on Highway, R. E. Toms. *Pub. Roads*, vol. 19, no. 5, July 1938, pp. 83–93. Review of modern United States designs for traffic movement, segregation, and safety; proper number, spacing, and width of traffic lanes; bypass roads; rotary intersections; freeways and parkways; channelizing islands; sidewalk designs in cut and in fill; road junctions and crossings; cloverleaf intersections.

SEWERAGE AND SEWAGE DISPOSAL

Disposal Plants, Great Britain. New English Development in Activated Sludge Treatment. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, p. 26. Principal design features of 66-mgd activated sludge sewage-treatment plant using double-deck aeration tanks being completed by London County Council at Barking, England; plant designed to produce stabilized (not highly nitrified) rather than completely purified effluent; sewage combined with activated sludge is circulated through 66 two-tier channels.

Filters. Die Rasenmenge in Tropfkoerpern, R. Poenninger. *Gesundheits-Ingenieur*, vol. 61, no. 3, Jan. 15, 1938, pp. 34–39; see also brief English abstract in *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, p. 34. Results of experimental study of relation between contact time and biological film of trickling filters; effect of dimensions of trickling filters on sewage purification.

Michigan. Fourteenth Annual Conference Michigan Sewage Works Operators, March 30 to April 1, 1938, W. F. Shephard and E. F. Eldridge. *Mich. Eng. Experiment Station—Bul. No. 79*, vol. 13, no. 5, Mar. 1938, 73 pp. Proceedings, including following papers: Operating Experiences and Results of First Year's Operation at Ann Arbor, H. P. Dodge; First Impressions of Sewage Treatment in Neighboring States, R. J. Smith; Jackson Sewage Plant Operation—Some Explanation for Low B. O. D. Obtained, R. A. Greene; Jackson Sewage Plant Operation—Method of Handling Supernatant Liquor, R. A. Greene; Jackson Sewage Plant Operation—Breakdown of Power Requirements, R. B. Jackson; Natural Stream Purification as Applied to Practical Measures of Stream Pollution Control, H. W. Streeter; What's New and Interesting in Sewage Treatment, L. H. Enslow; Comments on Sewage Rental in Ann Arbor, G. H. Sandenburgh; Application of Laboratory Analyses and Studies to Plant Operation, E. Hurwitz; Design Features of Lansing Sewage and Garbage Treatment Plant, W. R. Drury.

Sewers, Cleaning. Sewer-Cleaning Machines in New York City, H. W. Levy. *Am. City*, vol. 53, no. 8, Aug. 1938, pp. 51–52. Features and performance of Champion sewer-cleaning machine recently put into operation in New York City.

Sewers, Construction. Sewer Trenches Sheeted with Plywood Panels, C. H. Ashdown. *Eng. News-Rec.*, vol. 121, no. 3, July 21, 1938, p. 91. Replacement of customary trench support of timber sheeting, wales, and braces with simple plywood panels held by trench jacks on four large sewer projects, for Bloom Township Sanitary District at Chicago Heights, Ill.; savings effected by reduction in trench width, ease in handling sheeting, and elimination of wales.

Sewers, Surveying. Safety Precautions During Sewer Surveys, W. M. Caye. *Am. City*, vol. 53, no. 7, July 1938, pp. 41–44. Methods and equipment used in Louisville, Ky., during investigation of old brick sewers; protection against explosions; exploration parties; standard safety rules.

Sludge. Methods of Sludge Disposal in Canada, A. E. Berry. *Can. Engr.*, vol. 73, no. 23, Dec. 7, 1937, p. 14. Tabulated data on methods of sewage treatment and sludge disposal practiced in principal Canadian municipalities.

STRUCTURAL ENGINEERING

Arches, Concrete. Der Einfluss des "Kriechens" auf die Berechnung flacher Dreigelenkbogen, F. Glaser. *Bautechnik*, vol. 15, nos. 44 and 47, Oct. 8, 1938, pp. 565–567, and Oct. 29, pp. 609–612. Theoretical mathematical analysis of effect of creep of concrete on design of flat 3-hinge arches of reinforced concrete; numerical examples.

Beams, Continuous. Poutres continues en béton armé munies de table de compression, G. Mercy. *Annales de l'Institut Technique du Batiment et des Travaux Publics*, vol. 3, no. 3, May–June 1938, pp. 48–55. Theoretical discussion of methods of design of continuous reinforced concrete beams, pointing out possibility of reducing moments at supports in certain particular cases.

Beams, Steel. Temperaturverteilung in einen sonnenbestrahlten I-Traeger, O. Kluesener. Mitteilungen aus den Forschungsanstalten GHH *Konzern*, vol. 6, no. 4, May 1938, pp. 112–116. Temperature distribution in I-beam exposed to sunshine; temperature differences which occur due to unilateral solar radiation in beams can be calculated with aid of certain simplified assumption; example given.

Framed Structures. Should Type of Indeterminate Problem Determine Its Method of Solution, G. A. Maney. *Am. Concrete Inst.—J.*, vol. 9, no. 5, May–June, 1938, pp. 605–622. Review of modern methods of analysis for rigid-frame problems; case of multiple-joint rigid building frame under vertical or gravity loads; method of fixed-end moments; slope-deflection method; method of fixed-beam moments; moment area method; case of single-span frame.

Joints, Wooden. Plywood for Gusset Plates, H. N. Beckert, F. J. Hanrahan, and L. W. Smith. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 881–883. Progress report of Pennsylvania State College Laboratory on design of joints made with plywood and ring connectors; load capacity of joints; design recommendations; load-deformation curves showing contribution of friction, bolt bearing, and ring bearing to capacity of joint. See also *Engineering Index*, 1935, p. 599.

Standards. Normen und Vorschriften im oesterreichischen Bauwesen, K. Baherkalt. *Sparwirtschaft*, vol. 15, no. 9, Sept. 1937, pp. 233–239. Standards and codes in Austrian building industry; notes on rationalization and standardization; standards of engineering products and work; Standards Committee; distinction between standards and codes; safety factor takes precedence over economic factors; safety factor of structures.

Stresses, Contact. Formulas for Elastic Bodies, R. J. Roark. *Product Eng.*, vol. 9, no. 7, July 1938, pp. 278–280. Table of equations presented is summary of formulas for elastic stress and deformation produced under various conditions of loading by contact pressure between spheres, cylinders, and flat plates, etc.

Tile, Floor. New Reinforced Tile Construction Assembled on Building Site. *Brick & Clay Rec.*, vol. 93, no. 2, Aug. 1938, p. 26. New development in reinforced tile floors called Tilecrete is described; beveled 16-in. tile set on light-weight steel trusses and covered with concrete can be used for floors, ceilings, stairways, and roofs.

Walls, Soundproofing. Beitrag zur Bemessung und Beurteilung von schalldaemmenden Zweifachwaenden, H. Neubert. *Gesundheits Ingenizer*, vol. 60, no. 46, Nov. 13, 1937, pp. 704–706. Theoretical mathematical discussion of soundproofing of walls with intervening air space. Bibliography.

TRAFFIC CONTROL

Bridges. One-Way Traffic Rule Enforced by Automatic Device. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, p. 884. Description of device built into automobile roadway near administration building of Golden Gate Bridge, permitting automobiles to pass in one direction but automatically maintaining barrier against traffic in opposite direction.

TUNNELS

Mining. Ausbauten mit Betonfertigteilen auf Steinkohlenund Erzgruben unter Tage, E. Stephan. *Zement*, vol. 26, no. 49, Dec. 9, 1937, pp. 798–802. Tunnel linings with precast concrete blocks for underground coal and metal mines; illustrated description of typical examples.

Railroad, Great Britain. Severn Tunnel—Its Care and Maintenance, H. A. Alexander. *Engineer*, vol. 165, no. 4298, May 27, 1938, pp. 585–587. General history and description; supervision and personnel; conditions of service; ventilation; drainage; repairs; track and its repairs.

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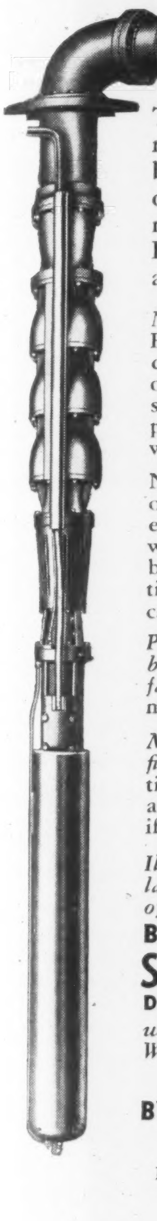

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ROADS AND STREETS, FRANCE. L'auto-route de l'ouest de Paris. *Technique Moderne*, vol. 30, no. 11, June 1, 1938, pp. 380–384. Construction features of automobile highway of west Paris with details of tunnel of Saint-Cloud and road and street intersections.

SUBWAYS, LINING. Concrete Lining for Tube-Railway Tunnels. *Engineering*, vol. 145, no. 3768, Apr. 8, 1938, pp. 400–401. Illustrated description of segment lining for Central London Railway extension; tests demonstrated that reinforced-concrete segments were as reliable as cast iron so far as strength to resist ram and earth pressure were concerned; twice usual proportion of reinforcement used in segments to ensure adequate strength; however, concrete segments are actually lighter than those in cast iron.

VEHICULAR, NEW YORK. Lincoln Vehicular Tunnel, New York. *Engineer*, vol. 145, nos. 3769 and 3771, Apr. 8 1938, pp. 375–377, 388, and Apr. 22, 3435–437, 448, supp. plates. Illustrated description. Similar description indexed in *Engineering Index*, 1937, p. 1207, from various sources.

WATER PIPE LINES, CORROSION. Drains Remove CO_2 From Tunnel. *Eng. News-Rec.*, vol. 120, no. 25, June 23, 1938, pp. 885–886. Method employed in solving unusual problem that arose from CO_2 gas entering Los Angeles aqueduct in one of Owens Valley tunnels; corrosion in steel siphons greatly decreased by drawing off gas through drain before it enters water; comparison of water content before and after gas drainage. See also *Engineering Index*, 1936, p. 1194.

WATER RESOURCES

UNDERGROUND REPLENISHMENT. Experience with Ground Water Replenishment, F. H. Tibbetts, *Am. Water Works Assn.—J.*, vol. 30, no. 2, Feb. 1938, pp. 326–334. Water geology of Santa Clara Valley in California; effect of construction of detention reservoirs, steam bed dams, and similar structures for replenishing underground water supply of valley.

WELLS. Record of Wells in Queens County, N.Y. *N.Y. Dept. Conservation Water Power and Control Commission—Bul. GW-6*, 1938, 240 pp. supp. map. Well logs and other appurtenant data, exclusive of those published in U. S. Geological Survey Professional Paper 44, prepared by U. S. Geological Survey in cooperation with Water Power and Control Commission and with Nassau and Suffolk counties.

WATER TREATMENT

OXYGEN DETERMINATION. Determination of Oxygen in Water in Presence of Nitrite, H. J. Bandt. *Sewage Works J.*, vol. 10, no. 2, Mar. 1938, pp. 377–380. Discussion of methods of oxygen determination in water containing nitrate, with special reference to Alsterberg azide method for destruction of nitrites; nitrite determination with indol and colorimeter according to Czensny. Abstract of paper previously indexed from *Gesundheits Ingenieur*, Sept. 4, 1937.

SOFTENING. Removal of Dissolved Salts from Water by Exchange Filters, P. G. Bird. *Am. Soc. Testing Matls.—Preprint No. 101*, mtg. June 27–July 1, 1938, 6 pp. Paper discusses newer organic types of exchanger bodies as applied to water treatment for complete or partial removal of dissolved salts; methods of using exchanger bodies described for effecting various types of exchange with results which should be expected from these materials.

SOUTH AFRICA. Cape Town Water Purification Plant. *Engineer*, vol. 165, no. 4297, May 20, 1938, pp. 557–560, and 568. Illustrated description of Kloof Nek filtration and treatment plant, in course of construction; raw water is highly colored, acid, and corrosive in character; in filter plant raw water will be coagulated with lime and alumina at pH of 8.5; water will then receive small dose of chlorine and be finally limed third time to pH of 9.2 before it enters main.

STEAM CONDENSERS. Taking the Bugs Out, S. A. Tucker. *Power*, vol. 82, no. 3, Mar. 1938, pp. 60–61. Review of new methods developed for chemical treatment of water supplies and means of application to condenser water; frequency, cost, and time factor of condenser water chlorination.

WATER WORKS ENGINEERING

ITALY. Il regime per l'approvvigionamento idrico della Sicilia. *Annali dei Lavori Pubblici*, vol. 76, no. 4, Apr. 1938, pp. 334–346. Tabulated data and structural notes on new water works in many Sicilian towns.

PALESTINE. Jerusalem Water Supply. *Engineer*, vol. 165, no. 4295, May 6, 1938, pp. 516–517 and 508; see also *Engineering*, vol. 145, no. 3775, May 20, 1938, pp. 575–576. 1,500,000 and 3,300,000 gal adopted as initial and ultimate capacities of plant; well pumps raise water from depth of 75 ft and deliver it into reservoir, whence it is pumped to second power station 22 miles away; four pumping stations identical in architectural features; three Harland single-stage horizontal centrifugal pumps each deliver 800–1,000 gal per min aginst head of 75 ft; driven by National 7-cycle vertical oil engines.

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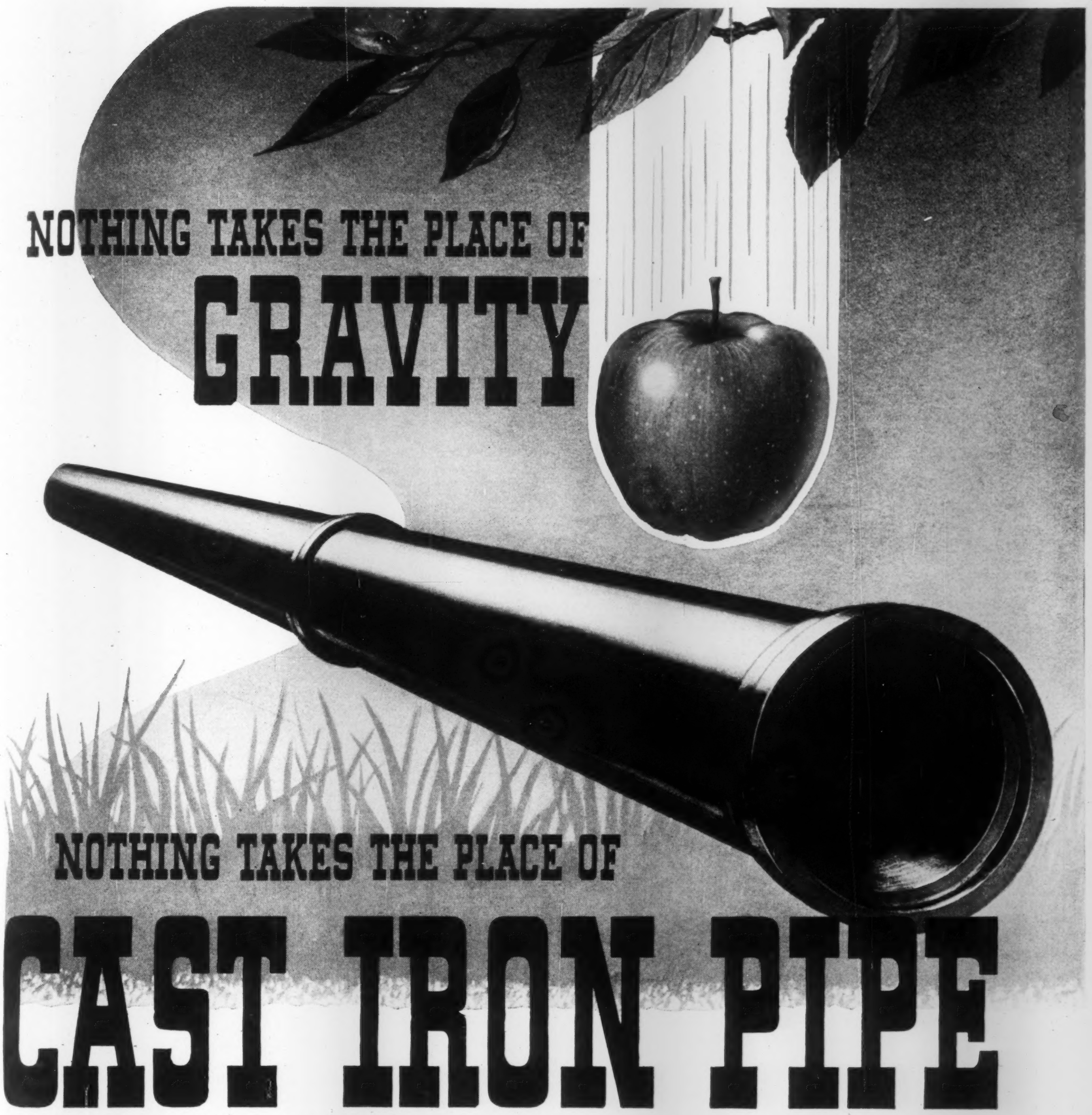

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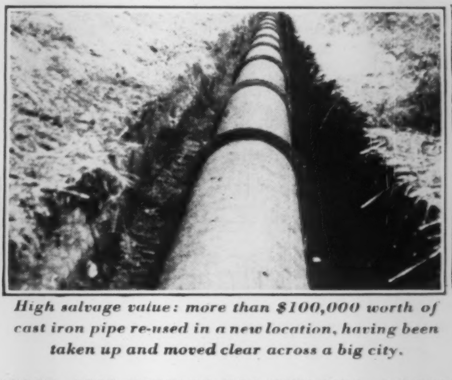

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Concrete Aggregates, Storage. New Type of Aggregate Stacker Developed at Guntersville Dam. *Construction Methods & Equipment*, vol. 19, no. 10, Oct. 1937, pp. 52–54. Description of radial stacker and reclaimer, revolving about center of five-leaf clover area, providing 200,000-ton aggregate storage, at Guntersville Dam, now under construction by Tennessee Valley Authority on Tennessee River.

Concrete Gravity, Construction. Small Concrete Crew Puts Out Big Yardage on Texas Dam. *Construction Methods & Equipment*, vol. 19, no. 7, July 1937, pp. 44–47. Rapid progress in building Roy B. Inks concrete gravity dam 70 ft high for Lower Colorado River Authority, Texas; construction layout; cableway of dam; major contract quantities and prices; progress chart.

Concrete Gravity, Earthquake Resistance. Dam Tested by Artificial Earthquakes. *Eng. News-Rec.*, vol. 121, no. 6, Aug. 11, 1938, pp. 184–185. Checking computed period of vibration of Morris Dam of water works of Pasadena, Calif., 328 ft high, by observing effect of vibrations caused by shaking machine that set up vibrations similar to those made by earthquake; deflection curves showing amplitude of vibration at various locations.

Concrete Gravity, Temperature. Die Temperaturmessungen in der Staumauer der Saaletalsperre am Kleinen Bleiloch, T. Musterle. *Bautechnik*, vol. 15, no. 55, Dec. 24, 1937, pp. 729–734. Study of temperature distribution records within body of Saale River Kleiner Bleiloch concrete gravity dam, 62 m high, during period, May 1931 to Dec. 1936, inclusive; control of temperature due to concrete setting; record of temperature of water impounded, at various depths, for period, 1932 to 1936, inclusive; temperature cracks.

Earth, Mexico. Building El Azucar Dam. *Eng. News-Rec.*, vol. 121, no. 8, Aug. 25, 1938, pp. 227–229. Features of El Azucar earth-fill dam across San Juan River, northern Mexico, 138 ft maximum height, 3.7 miles long; spillway, controlled by 9 stoney gates 529 ft wide, has capacity of 742,000 cu ft per sec, equivalent to 57 cu ft per sec per sq mile of watershed.

Earth, Utah. Moon Lake Dam and Reservoir, Moon Lake Project, Utah. E. J. Westerhouse. *Reclamation Era*, vol. 28, no. 8, Aug. 1938, pp. 164–166 and 171. Description of new earth-fill dam 35 miles north of Duchesne, Utah; about 100 ft high.

Earth, Wyoming. Alcova Dam, J. A. Beemer. *Reclamation Era*, vol. 28, no. 8, Aug. 1938, pp. 167–169. Description of new earth-fill dam located in Alcova Canyon, 32 miles southwest of Casper, Wyo., 265 ft in height above lowest point of foundation and 763 ft long; foundation work; embankment construction; appurtenant structures.

Multiple Arch, Texas. Buchanan Dam Builders Produce Quick Results with Force-Account Organization. *Construction Methods & Equipment*, vol. 19, no. 9, Sept. 1937, pp. 42–46. Design and construction of Buchanan Dam for flood-control and water conservation on Colorado River near Burnet, Tex., embracing in its total length of more than 2 miles diverse types of dam structures including multiple-arch section 2,030 ft long, 158 ft maximum height; arch spans are 70 ft long.

Reservoirs, Concrete. Low Cost Water Storage, D. E. Davis. *Eng. News-Rec.*, vol. 121, no. 10, Sept. 8, 1938, pp. 301–302. Use of thin wall and dome air-shot mortar, or shotcrete, for construction of circular tank reservoir for water works of Oakland, Md., holding 325,000 gal with water depth of about 22 ft.

Reservoirs, Concrete. Three-Story Reservoir of Novel Construction, La Marec. *Eng. News-Rec.*, vol. 121, no. 8, Aug. 25, 1938, p. 230. Features of reinforced concrete reservoir recently completed at Nantes, France, described in article indexed in *Engineering Index*, 1937, p. 986, from *Génie Civil*, June 19, 1937.

Reservoirs, Design. Détermination graphique de la capacité nécessaire à un barrage-réservoir, V. Cherre. *Génie Civil*, vol. 113, no. 2918, July 16, 1938, pp. 59–61. Graphical methods for computing required storage capacities of water tower and irrigation reservoirs, also requisite type of dam for given topography; numerical examples.

Reservoirs, Leakage. Leakage Stopped with Grout Wall. *Eng. News-Rec.*, vol. 121, no. 10, Sept. 8, 1938, pp. 289–291. Method of stopping leakage through fractured rock in right abutment of dam at Little Rock, Ark., by cement grounding of rock through holes drilled from surface of dam; leakage was stopped more effectively and at less cost after dam was built, than would have been possible before or during construction of dam.

Spillways. Bigger Spillways for Salt River Dams. *Eng. News-Rec.*, vol. 121, no. 6, Aug. 11, 1938, pp. 174–177. Enlargement and improvement of spillways of Roosevelt, Horse Mesa, Mormon Flat, and Stewart Mountain dams, varying in height from 212 to 305 ft, on basis of model tests which showed that they discharged only about 60 per cent of their design capacity.

FLOOD CONTROL

California. Flood of March 2, 1938, M. F. Burke. Los Angeles County Flood Control District No. 43, May 1938, 53 pp., plates, tables, charts. Detailed hydrological report on unprecedented catastrophic flood, including records of rainfall, runoff, dam operation, debris measurements, and area of inundation; data compared with those for previous extreme floods.

FOUNDATIONS

Cofferdams, Construction. Tailor-Made Cofferdams. *Eng. News-Rec.*, vol. 121, no. 7, Aug. 18, 1938, pp. 207–211. Building and holding two 28 by 60-ft cofferdams, in 50 to 75 ft of open water, with only shallow cover over bedrock, or pier foundations of Deer Isle-Sedgwick suspension bridge in Maine; cofferdams were built up of sheet piling and steel framing, trimmed to fit bedrock contours and dropped to place by huge floating derrick; bridge history and design.

Piles, Concrete. Reinforced Concrete Screw Piles. *Engineer*, vol. 166, no. 4303, July 1, 1938, p. 26. Illustrated description of new process developed by G. Grimaud, used successfully in several works, notably for bridge foundations and in works incidental to moving of railway lines; screw pile of special shape can be precast or cast in mold formed by special sleeve in ground; reinforcement consists of spiral network inclined at angle of 45 deg; screw piles stated to be particularly useful where vibration and noise must be avoided or in confined positions.

Piles, Steel. Beitrag zur Berechnung eingespannter Spundwaende, P. Hedde. *Bautechnik*, vol. 15, no. 51, Nov. 26, 1937, pp. 659–636. Presentation of simplified graphical method for design of fixed sheet-piling walls; analytical method of design.

Railroad Stations. Underpinning of Freight Office Overcomes Settlement, A. N. Laird. *Ry. Eng. & Maintenance*, vol. 34, no. 9, Sept. 1938, pp. 542–543. Sawdust, logs, and waste lumber, in filled ground under Grand Trunk freight station at Grand Rapids, Mich., decayed after water table was lowered following filling of mill race; this resulted in irregular settlement of building to maximum of 10 in.; how footings were underpinned and structure raised to its original elevation in manner that resulted in closing cracks in brick walls, described.

HYDRAULIC ENGINEERING

Silt, Transportation. Etude Expérimentale du Transport Solide dès Cours d'Eau, A. Jorissen. Revue Universelle des Mines, vol. 14, no. 53, Mar. 1938, pp. 269–282. Results of theoretical and experimental studies of transportation of silt and other river-bed materials, with special reference to work recently done in United States. Bibliography.

INLAND WATERWAYS

Canals, Silt Control. Desilting Works at Imperial Dam, D. M. Forester. *Reclamation Era*, vol. 28, no. 8, Aug. 1938, pp. 152–156. Description on special desilting works at head of All-American canal system in California; mechanical removal of silt; operation of sluiceway channel; control of scrapper mechanisms.

LAND RECLAMATION AND DRAINAGE

San Francisco. Exposition Island Formed by Hydraulic Dredging. *Construction Methods & Equipment*, vol. 19, no. 7, July 1937, pp. 51–52. Providing site for Golden Gate International Exposition of 1939 by creating 400-acre, man-made island in San Francisco Bay by hydraulic dredging and sea-wall construction, involving placement of 25,000,000 cu yd of hydraulic fill and 280,000 tons of rock.

MATERIALS TESTING

Cement. Properties of Portland Cement and Methods of Determining Them, G. A. Ashkenazi. *Cement & Lime Manufacture*, vol. 11, no. 6, June 1938, pp. 119–125. Critical discussion of accepted standard methods of testing cement and their relations to actual performance of concrete structures. Bibliography.

Cement Asbestos. Properties of Asbestos-Cement Sheets. *Cement & Lime Manufacture*, vol. 11, no. 8, Aug. 1938, pp. 182–184. Abstract of 1937 annual report on Building Research Board of Great Britain giving results of tests of asbestos cement roofing materials; effect of wetting and drying cycles on various properties of asbestos-cement flat slates; solvent action of rain water; effect of atmospheric carbonation; effect of freezing and thawing cycles on asbestos-cement roofing materials.

Concrete. La consistance du mélange du béton et la fixation préalable de sa résistance à l'écrasement, F. von Emperger. *Travaux*, vol. 22, no. 66, June 1938, pp. 263–270. Review of recent European research on consistency of concrete mixes and predetermination of crushing strength.

Earth. Compaction Tests and Critical Density Investigation of Cohesionless Materials for Franklin Falls Dam. Merrimack Valley Flood Control. Boston, Mass., U. S. Army, Corps of Engrs., Apr. 1, 1938, 80 pp., numerous supp. plates. Results of laboratory and field tests of compaction of silt and sand materials by rolling, tamping, vibration, and jetting.

Timber and Concrete. Timber and Concrete Strength. *Eng. News-Rec.*, vol. 121, no. 4, July 28, 1938, pp. 115–117. Proceedings of 1938 Conference on Materials at Massachusetts Institute of Technology, including abstracts of papers on form factors of timber beams, L. J. Markwardt; lumber grading, L. W. Smith; deterioration of wood, C. H. Blake; cement composition, B. H. Bates; concrete variability, M. N. Clair; microstructure of concrete vs. strength, W. C. Voss; disagreement between actual stress conditions in masonry dams and those assumed in design, A. P. Karpov.

PORTS AND MARITIME STRUCTURES

France. La construction du port Edouard Herriot, a Lyon, par la Compagnie Nationale du Rhone, J. Couteaud. *Génie Civil*, vol. 113, no. 2919, July 23, 1938, pp. 73–80. Construction of river port Edouard Herriot at Lyon, France, by Compagnie Nationale du Rhone; details of basins; features of excavating and dredging equipment; power supply, lighting, water supply; protective measures against aerial attack, etc.

France. Les travaux d'extension du port de Dunkerque, P. Jong. *Travaux*, vol. 22, nos. 61, 62, and 64, Jan. 1938, pp. 1–10; Feb., pp. 63–72; and Apr., pp. 167–172. January: History of port of Dunkerque, France, and description of extensions, including jetties and breakwaters. February: New marine lock 325 m long, 43 m wide; steel-truss bascule bridge and other structures. March: Levee revetments, retaining walls, earth fills, lighthouse, etc.; new slip for English Channel ferry boats. (To be continued.)

Wooden. Timber Seawall and Bulkheads. *Eng. News-Rec.*, vol. 121, no. 4, July 28, 1938, pp. 108–109. Description of successful type of construction consisting of splined 10 by 18-in. creosoted timbers driven as sheet piles in breakwater and retaining wall at Everett, Wash.; estimated to have life of over 40 years.

ROADS AND STREETS

Bituminous. Grout-Bound Broken Stone Base with Light Bituminous Surface Provides Economical Texas Pavement. *Construction Methods & Equipment*, vol. 19, no. 10, Oct. 1937, pp. 44–47. Construction of 11 miles of cement, grout-bound, broken stone base course surfaced with light asphalt wearing course, south of San Antonio, Tex., as economic pavement for roads carrying up to 3,000 vehicles per day; multi-holed distributor box at end of chute deposits grout on broken stone base, where it is worked into voids by hand brooming.

Bituminous. Thin Drag-Spread Bituminous Road Surfaces, J. Mathieson and A. H. Gawith. *Instn. Engrs. Australia—J.*, vol. 9, no. 11, Nov. 1937, pp. 434–443. Design and construction of thin bituminous road carpets laid on existing pavements or prepared bases; changes in grading that occur in service; methods of laying surfaces and cost.

Brick. Baltimore Paves Widest Street with Brick, V. J. Brown. *Roads & Streets*, vol. 80, no. 11, Nov. 1937, pp. 25–29. Construction of brick street paving of Fifth Regiment Armory Plaza 190 ft wide and 373 ft long; table of quantities.

Concrete. Dont's for Concrete Highway Builders, C. B. Breed. *Construction Methods & Equipment*, vol. 19, no. 7, July 1937, pp. 54–55. Suggestions and rules for construction of longitudinal and transverse joints in concrete pavements, form setting, finishing of surface, etc.

Construction. Construction Methods and Records on Mississippi Concrete Job, R. Boren. *Roads & Streets*, vol. 80, nos. 9 and 10, Sept. 1937, pp. 25–30, and Oct., pp. 39–44. Practices developed in carrying out $42,000,000 highway construction program of Mississippi, including use of new dual-drum paver and ingenious details in grading, joint setting, and concrete handling; slab and joint characteristics; materials handling and storage.

Construction. Direct Road Construction on Soils by Heat Treatment. *Engineering*, vol. 146, no. 3782, July 8, 1938, pp. 39–41, supp. plate. System developed by Australian engineer, L. R. H. Irvine, who established fact that almost any soil could be converted, by heating after suitable preparation, into material resembling brick; machine employed consists of furnace, or burner, suspended within wheeled chassis, and so arranged that it can be adjusted with its heating portion at any angle or height to suit surface of road under treatment.

Construction. Highway Construction in California, E. Withycombe. *Roads & Streets*, vol. 80, no. 12, Dec. 1937, pp. 35–38. Construction progress and pavement records for 1936; grading and pavement foundation; portland cement concrete; asphalt concrete; bituminous treated surfaces.

Construction. Management of Highway Grading, J. L. Harrison. *Roads & Streets*, vol.

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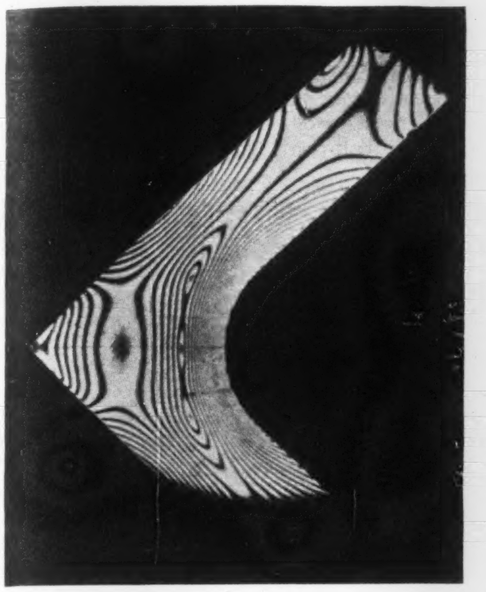
with LARGE Aperture PHOTOELASTIC POLARISCOPE

Simplifies Design Problems



Angle Plate under Stress

Photograph of the apparatus with quarter wave plates swung out of position

DON'T GUESS AT AREAS OF STRESS CONCENTRATION! *See them visually.* DON'T GUESS AT AMOUNT OF STRESS! *Measure it quantitatively.* Axial loads do not always cause uniform stress distribution. The dimensions of a part are not necessarily an indication of its strength. Testing machine parts to the point of breakdown and thus approximating stress data can lead to conclusions which are at considerable variance from actual conditions.

The importance of photoelasticity for stress determination has been known for some time but in many cases, use has not been made of it because of the many objections to the Nicol prism arrangement to which one was limited prior to the development of Polaroid. In contrast to the complex apparatus heretofore used is the Polaroid-equipped photoelastic polariscope which is simple in construction, convenient for use and much lower in cost. The change in design has been made possible only by the development of large area polarizing media and large area quarter wave plates. Standard sizes are available in apertures of $4^1/_4''$, $6^1/_4''$, and $8^1/_4''$; special sizes can be had up to 12″ aperture. The light source may be ordinary light or mercury light (fitted with filter for 5461 Å). And for those who wish to construct their own apparatus, we will furnish any of the parts.

Now available—a loading frame of the universal type—for tension, compression, and bending. The illustration shows a rigid frame bridge model with loading being applied to cause bending primarily. Write for descriptive literature.

The illustration shows an instrument of $4^1/_4''$ aperture mounted on an optical bench one meter long. The four units are:

The Light Source, consisting of illuminant, filter for 5461 Å (with mercury light), condenser and collimating lens, within a single compact unit.
The Polarizer and quarter wave plate mounted in unit on a single rider but calibrated and rotated independently of each other.
The Analyzer and quarter wave plate similar to Polarizer.
The Projection system.

The polarizer and analyzer are set in rotating mounts with scale reading for 180°; the quarter wave plates are in rotating mounts with scale reading for 90°.

By this unique arrangement, this new model with its simplified construction facilitates photoelastic investigation. For taking the isoclinics, the quarter wave plates are merely swung out of position; for photographing the stress fringes, the quarter wave plates are swung back into position and automatically, into correct optical alignment. At all times, every part of set-up is fixed in correct optical alignment.

The simplicity of the instrument is accentuated by the fact that there are no lenses in any position between the polarizer and the analyzer, eliminating inaccuracies caused by strained lenses, or depolarization which occurs at the edges of lenses.

The $4^1/_4''$ aperture with "white" light source is priced at $300.00

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* *T. M. Reg. U. S. Pat. Off. by Polaroid Corporation*

POLARIZING INSTRUMENT COMPANY

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Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

J. & L. Makes Wire Rope

A new plant, thoroughly modern from factory buildings to each precision machine, has been erected at Muncy, Penna., for the manufacture of wire rope, by Jones and Laughlin. This new plant will be known as the Gilmore Wire Rope Division of the Jones and Laughlin Steel Corporation. Mr. Robert Gilmore, who has devoted his entire business life to the development and manufacture of wire rope, is General Manager of this Division.

He states that the plant will produce immediately superior ropes for all the major markets.

Automatic Strainer

An automatic self-cleaning strainer has been announced by Blackburn-Smith Mfg. Co., Hoboken. N.J. The unit consists of the cast iron body; its inner perforated, cylindrical bronze strainer basket; an operating motor, a pressure switch, and a diaphragm-actuated gate valve on the waste discharge connection. The perforated strainer basket is partitioned into sections and rotates about its axis.

It is reported that in operation the accumulation of strained matter in the basket causes a slight lowering of pressure at the outlet which closes the pressure-actuated switch. This starts the motor, rotates the strainer basket and opens the waste discharge valve, thus cleaning the basket sections by flushing with clean water. The completion of the cleaning process again raises the discharge pressure, stops the motor, and closes the waste valve.

New Portable Electric Grinders

Three new Thor Grinders, in 4 in., 5 in., and 6 in. diameter wheel capacities, are now being manufactured by the Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, Ill.

The 4 in. grinder, known as the Thor U54, is recommended for fast grinding on light jobs. It weighs 10 lbs, is 19 in. long, and operates at a free speed of 6,000 rpm. The 5 in. grinder, Thor U55, operates at a slower speed for heavier duty work. It weighs $10^1/_4$ lbs, is $19^1/_2$ in. long, and runs at a free speed of 4,500 rpm. The 6 in. grinder, Thor U60, is designed for the hardest grinding jobs and weighs 20 lbs, is $24^1/_2$ in. long, and has a free speed of 6,000 rpm. A booklet, giving specifications and prices, is available upon request.

Miles Heads Asphalt Department

Effective November 1, 1938, E. W. Miles has been appointed Manager of the Asphalt and Fuel Oil Department of the Standard Oil Company, Indiana, to replace C. C. Lakin, who will retire. A. T. Hague has been appointed Assistant Manager of the Asphalt and Fuel Oil Department.

New Symbol Chart

On a single chart, 26 by 35 in., The Frederick Post Co., manufacturers of engineering and architectural instruments and supplies, has compiled 249 authentic drafting symbols. These "every-day" and a great many "hard to find" symbols were selected with the cooperation of architectural and engineering societies and groups. Engineers and architects may obtain copies of this chart upon request to The Frederick Post Co., Chicago, Ill.

New $16^1/_2$ Ton Truck Crane

The growing popularity of truck-mounted shovels and cranes has created a demand for a "heavier machine on wheels," and to meet this demand, Bay City Shovels, Inc., Bay City, Mich., has developed a new heavy-duty, $^3/_4$ yd, $16^1/_2$ ton crane capacity full revolving, mobile truck shovel-crane designated as Model 18, recommended for use on a truck having gross rating of 50,000 lbs, equipped as 6-wheeler with dual drive.

Features of the Model 18 are: upper revolving turn-table and roller path of large diameter with internal ring gear of unit-cast nickel manganese steel; liberal use of anti-friction bearings on all machinery shafts and in boom sheaves; clutches and brakes of external contracting band type; "E-Z" control booster operated hoist and auxiliary hoist; positive pattented swing lock securely locking rotating base; electric dipper trip for shovel operation; self-locking boom hoist; cab of heavy 10-gage formed sheets; shatter proof safety glass; swing speed of 5 rpm; standard 30 ft boom of heavy structural lattice type construction. Special alloy steel booms can be furnished with removable sections up to 80 ft. Additional details in Bulletin B.

Speed Maintainer

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just announced the Speed Maintainer, a new finishing and maintenance tool which is one-man operated and will maintain average earth or gravel roads at from $3^1/_2$ to $4^3/_4$ miles per hour. It is said to be particularly well adapted to highway shoulder maintenance, while its ability to turn short, in a 16-ft circle, makes it useful for fine grading between forms, or in narrow alleyways. It is mounted on pneumatic tires and has a top speed of nine miles an hour. A bulletin, describing the machine in detail, is offered.

Earth-Moving Calculator

An improved grade and haul calculator for 12-yd Carryalls is ready for free distribution through R. G. LeTourneau, Inc., Peoria, Ill., or Stockton, Calif.

Millions of yards of dirt and thousands of time studies form the basis of possible computations in connection with LeTourneau equipment, such as: production and costs for varying distances and grades, expected delivery per hour, probable cycle in minutes per trip, expected trips per hour, maximum haul distance possible, and time required to travel any distance up to a mile in a given tractor gear and speed.

Automatic Desludging Valve

Developed as a part for its hot process lime soda water softener in which sludge must periodically be removed from a settling tank. The Permutit Company, 330 West 42nd St., New York, N.Y., has placed upon the market an automatically operating valve for permitting the flow of sludge from a container by gravity or under pressure.

Automatic operation of such a valve is highly desirable because periodic desludging is likely to be overlooked or postponed. With automatic desludging this is accomplished under precise control, assuring uniform conditions. The valve is motor operated and of simple construction. Booklets are furnished upon request.

CUTTING ON A FILL!

HERE'S a fill—and it's a big one—on the state highway near Crestline, California. The *cut* is in the cost of fuel. For as this "Caterpillar" Diesel Tractor works two eight-hour shifts, on this 200-foot fill, it uses *only* 3 gallons of low-cost fuel an hour!

That's the kind of economy you can expect, whether a "Caterpillar" Diesel is driving a lot of dirt ahead of the blade—or hauling it behind in scrapers or wagons. Because these machines are built to give you *low*

Low because of low fuel cost . . . but *even lower* as you count in the saving of time that comes from their sure-footed traction . . . another saving of time and a saving of money on maintenance and repairs . . . and still another saving in low yearly depreciation that results from long serviceable life.

It's no wonder that contractors and private industry are *driving down* costs with "Caterpillar" Diesels. See nearest "Caterpillar" dealer for facts and figures that apply to *your* job!

CATERPILLAR

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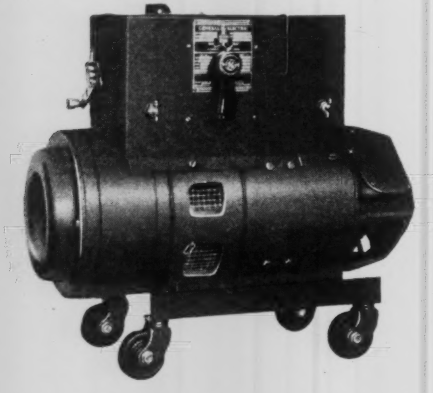
TRACTOR CO., PEORIA, ILL.

New Arc Welders

The General Electric Co., Schenectady, now offers two new Arc Welders which further extend its line into the field of light-gage work.

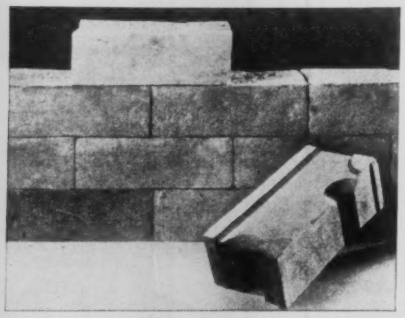


A 50-ampere, direct-current, single-operator arc welder is equipped for high, instantaneous recovery of voltage and stability against excessive current surges. Any welding current within its range can be quickly obtained by means of a three-point selector switch and an easily operated dial for intermediate adjustment. Isothermic overload protection permits maximum safe overloads.

The new 150-ampere alternating current arc welder of the transformer type, while chiefly intended for use on light-gage metals, can also be used on fairly heavy materials. It is built with woven, spun-glass, fireproof insulation, and solidly brazed internal connections. Continuous, stepless current control is obtainable by means of a hand-crank. A choice of two open-circuit voltages (80 and 100 volts) is provided.

Pour-Lay Brick

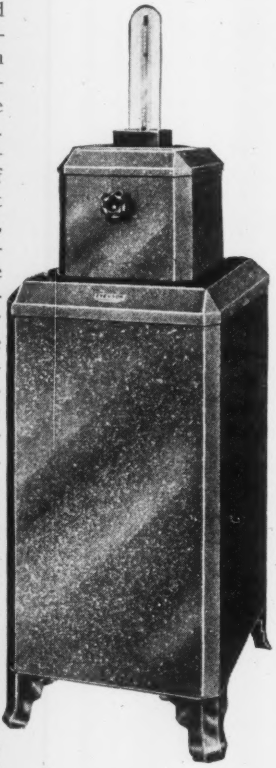
The Sauereisen Cement Company, Sharpsburg, Pa., has designed an acid-proof brick known as the Sauereisen Pour-Lay Brick. The brick is particularly adapted to use in all types of acid-proof construction such as acid pickling tanks, sewers, floors, tunnels, etc. Design includes pouring cavities so arranged as to allow the brick to be laid dry and in such a manner as to present a smooth, solid surface without joints. A molten sulphur or asphaltic joint compound is used for sealing, no spacers or joint seals being required.



Automatic Vacuum Controlled Chlorine Sterilizer

Everson Manufacturing Company, 214 West Huron St., Chicago, Ill., announce a new "Automatic Vacuum Controlled" Chlorine Sterilizer for the water works and sewerage field.

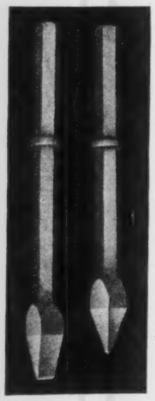
This new instrument, which measures and feeds chlorine gas as a solution, is claimed to have many new and improved features which make it automatically safe and accurate. These are: visible control of gas flow, great capacity range, only two moving parts, single valve control located directly below visible meter, automatic gas shut-off, electrically operated water shut-off, complete vacuum feed, separation of water and gas lines, water-sealed gas vent with siphon break that prevents back flooding, operation with low water pressure, all parts easily accessible and entirely non-corrosive, Standard (SAE) threads and parts. This Sterilizer, which will be in the "low price field," is offered in a choice of cabinets and designs.



New Type of Steel for Concrete Busters

The Sullivan Machinery Co., Michigan City, Ind., has developed a new type of steel known as "Arropoint," designed for use with pneumatic concrete busters.

The outstanding feature of the new steel is an upset end which provides a wider, more efficient point angle and locates more stock at the working end of the steel to provide greater resistance to drilling and breakage. It is claimed that Arropoint steels last longer, stay sharp longer, break concrete faster, and are easier on the operator than conventional steels. They are available in all standard buster steel sizes and with both pick (moil) points and narrow chisels. Bulletin Arro-838 catalog types and sizes.



Literature Available

Bridge Plates—What to do about unsafe small bridges is a question confronting every highway department. Armco Culvert Manufacturers Association, Middletown, Ohio, offers a solution in its folder, "A Plea for Safer Highways."

Compressors—Sullivan Machinery Co., Michigan City, Ind., has released an attractive 20-page catalog (Bulletin A-22) describing and illustrating their Unitair stationary and semi-portable air compressors, available for displacements ranging from 107 to 435 cu ft per minute and for commercial pressures up to 125-lbs.

Corrosion—An Encyclopedia of Corrosion - Prevention - Correction - Protection and Maintenance Coatings, of 28 well-indexed pages, has been issued by Technical Protective Coatings, Inc., 3248 Long Beach Ave., Los Angeles, Calif.

Cranes—Catalog 700-G-11 and Catalog 600-L-2 describe and illustrate, respectively, the "American Gopher" shovels, draglines, clamshell cranes, and the "American" 40- and 50-ton locomotive cranes manufactured by the American Hoist & Derrick Co., St. Paul, Minn.

Piles—A new 20-page catalog (No. 68) on Fluted Monotube Piles has been released for distribution by The Union Metal Manufacturing Co., Canton, Ohio. In addition to describing the product and method of installation, this catalog contains complete engineering data and illustrations of interesting Union Metal jobs.

Road Machinery—"Change By-Ways to Highways," 32-page booklet just off the press, covers the entire line of Speed Patrols manufactured by Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Snow Plows—Bulletins SNP-3 and SNP-4 illustrate and give specifications for various types of snow plows manufactured by American Hoist & Derrick Co., St. Paul, Minn.

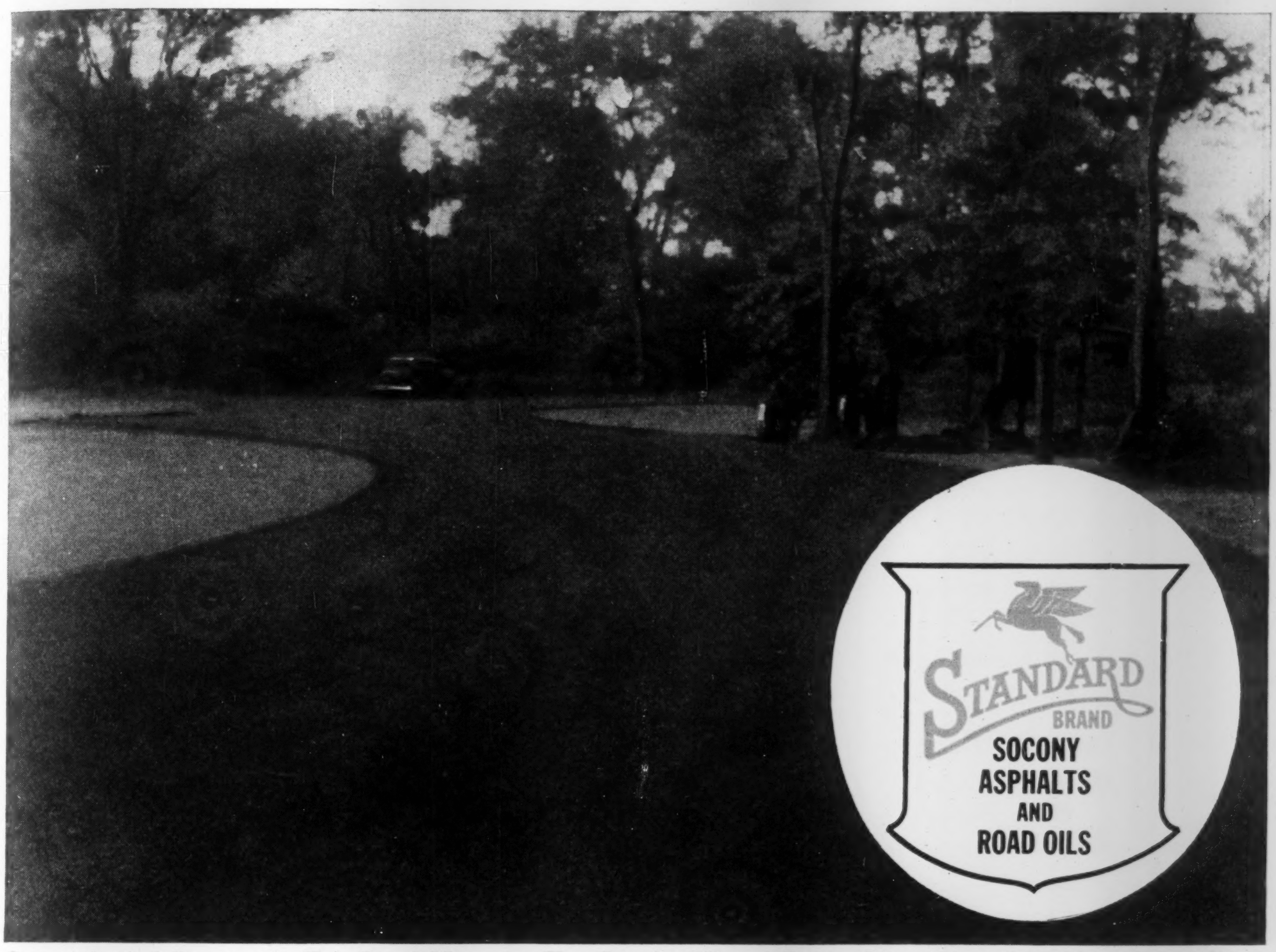
Telemetering—The Bristol Co., Waterbury, Conn., have published a new 24-page bulletin (No. 515) covering the Metameter System of Telemetering, with line drawings showing principle of operation and method of installation.

Tractors—Operating costs and specifications of the 25-hp "Caterpillar" Diesel D2 Tractor are given in a profusely illustrated booklet, Form 4757, just published by the Caterpillar Tractor Company, Peoria, Ill. Action photos are included.

Water Measuring System—Blaw-Knox Co., Pittsburgh, Penna., has prepared a bulletin, No. 1643, describing the operation of its water measuring system on Trukmixers. There is a graphic explanation of the method of water flow and control, and a summary of tests conducted by a State Highway Department Engineer under different gage settings and with tank in various positions.

Welder—A 200-ampere capacity engine-driven welder, especially designed for rural and field service where power supply is not available, is described in Leaflet 26-140, published by Westinghouse Electric & Mfg. Co., East Pittsburgh, Penna.

ANOTHER GOOD ROAD MADE BY GOOD ENGINEERING AND GOOD PRODUCTS



Socony Asphalt Penetration Type Road, Monomac Top, Standard Brand, Beaver Island State Park, Grand Island, N.Y.

SOCONY Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Socony Asphalt Emulsions • *Specifications and all other particulars furnished on request.*

SOCONY-VACUUM OIL CO.
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TIDE GATES

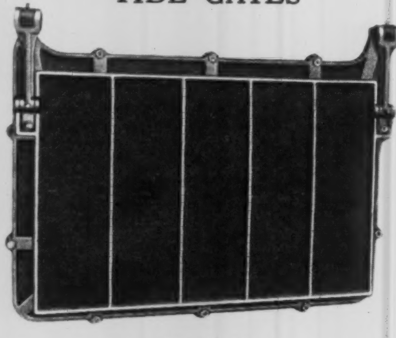

Fig. M-M

Made of all metal; upper hinge lugs are adjustable to provide correct seating even though foot walls are out of plumb; lower lip of nozzle is inclined downwardly and outwardly to increase velocity of very small flows to minimize deposit of sludge on seat; seats faced with non-corrosive metal if required; built to withstand back pressures due to 12′, 20′ and 40′ head.

Fig. M-M Gates are intended for use where conditions of free discharge normally exist.

Fig. M-M-C Gates have cellular shutters designed to weigh 70 pounds per cu. ft. of displacement. Recommended for use under conditions of submerged discharge.

Stock Sizes

12″x12″	24″x24″	36″x36″	42″x63″
12″x18″	24″x36″	36″x48″	48″x48″
18″x18″	30″x30″	36″x54″	48″x72″
18″x27″	30″x45″	42″x42″	

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80, nos. 11 and 12, Nov. 1937, pp. 31–34, and Dec., pp. 29–32. November: Some of details that influence production of power shovel and elevating grader outfits as used on highway construction; tooling of power shovel job; effect of length of haul; rules for calculating number of hauling units required. December: Calculating hauling equipment for job; hauling units; balanced tooling and profits; effect of fixed costs.

Drainage. French Drains Cure Frost Boils. *Eng. News-Rec.*, vol. 121, no. 10, Sept. 8, 1938, p. 292. Construction of stone-filled French drains under roadway and deep side ditches to do away with trouble from frost heaves and boils on 8 miles of secondary-type road in Rio Grande county, Colorado; cost data.

Earth. Earth Roads in South, C. S. Hill. *Eng. News-Rec.*, vol. 121, nos. 9 and 10, Sept. 1, 1938, pp. 259–264, and Sept. 8, pp. 306–310. Sept. 1: Survey of road soils and methods of processing them for modern earth roads; development of earth road system of Virginia. Sept. 8: Florida practice in design and construction of lime-rock and sand-asphalt bases; soil stability tests; experience record; stage processing; highway direction.

Highway Accident Prevention. Engineering Highway for Safety, R. E. Toms. *Roads & Streets*, vol. 80, no. 11, Nov. 1937, pp. 58, 60, 62, and 64–65. Geometric features of highway design; speed factor in design; sight distances; use of stop and slow signs; design features of 4-lane highway; dangers of unrestricted access.

Highway Accident Prevention. Visibility and Night Traffic Accidents, L. A. S. Wood. *Roads & Streets*, vol. 80, no. 12, Dec. 1937, pp. 44–46 and 48. Fatality records; night visibility; polarized light; driver visibility; pavement brightness; luminaires and lamps; highway lighting installations; cost of highway lighting; financing highway lighting. Before Safety Congress of Nat. Safety Council.

Highway Administration, Oregon. Economics of Highway Planning Propounded by Oregon Engineers, C. B. McCullough and J. Beakey. *Roads & Streets*, vol. 80, no. 10, Oct. 1937, pp. 61–72. Fundamentals in highway economics; basic factors; highway transport setup; problems in highway administration; solvency factor; solvency quotient; investigation of total or system solvencies; benefit factor; road user benefits; combination of factor groups. From *Oregon State Highway Dept.—Tech. Bul.* No. 7.

Intersections. Unbalanced Road Intersection. *Eng. News-Rec.*, vol. 121, no. 6, Aug. 11, 1938, pp. 172–173. Description of new experimental type of road intersection on U. S. Routes 30 and 41, in northwestern Indiana; all approaches to intersection are four lanes wide; all exits are of two-lane width.

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Bacteriology. Growth-Promoting Substances in Sewage and Sludge, W. Rudolfs and R. S. Ingols. *Sewage Works J.*, vol. 10, no. 4, July 1938, pp. 653–660. Studies of indole and skatole in sewage and in fresh, stable, digested, and activated sludges; effect of sludge treatment by dewatering and drying and of principal types of sewage treatment; value of various sludges for fertilizer base and value of effluents for land use. Bibliography.

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Madison, Wis. Reliable Water Service, W. W. DeBerard. *Eng. News-Rec.*, vol. 121, no. 6, Aug. 11, 1938, pp. 169–172. Review of developments of water works of Madison, Wis., since 1882; description of present distribution system; meter practice; location survey and record; meter-testing outfit; meter inspection; research and finance.

Motor Truck Service. Water Service Truck. *Eng. News-Rec.*, vol. 121, no. 1, July 7, 1938, p. 32. Description of service truck, including meter testing and repair bench, developed by Bureau of Water Works and Supply of Los Angeles, Calif.

New York City. Development of Delaware Water Supply System, C. M. Clark and F. H. Nowaczek. *Mun. Engrs. J.*, vol. 24, 1st quarterly issue, 1938, pp. 25–47, (discussion) 47–49. History of Delaware water supply project for New York City and report on first stage of its construction; contracts awarded to date; construction methods and progress; shaft construction; Lackawack Dam exploratory caissons; appurtenant construction.

Proceedings of Conference. Proceedings of Eleventh Annual Conference on Water Purification, E. S. Tisdale and H. W. Speiden. *West Va. Univ.—Eng. Experiment Station—Tech. Bul. No. 9*, series 38, no. 3, Sept. 1937, 58 pp. Softening Plant for Morgantown, C. E. Trowbridge; Tygart River Dam, W. E. R. Covell; Experiences During 1936 Ohio River Flood, A. R. Todd; Effect of Coal Mine Drainage on West Virginia Rivers and Water Supplies, W. W. Hodge; Thawing Mains and Services, W. S. Staub; Effect of Sewage Treatment on West Virginia Water Supplies, H. W. Speiden; Filter Stoppage by Micro-Organisms, K. Waldeck; Challenge of West Virginia, A. C. Spurr; Role of Chlorine in Water Purification, A. E. Griffin.

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St. Augustine, Florida. Color and Hardness Removed from St. Augustine Water. *Am. City*, vol. 53, no. 9, Sept. 1938, pp. 69–72. Description of new 2-mgd water treatment, lime softening plant of St. Augustine, Fla.; details of aeration and decolorization processes; chemical treatment; low-lift and wash-water pumps.

WATER WORKS ENGINEERING

Boston, Mass. Metropolitan District Water Supply Commission and Department of Public Health Relative to Improvements in Distribution and to Adequate Prevention of Pollution of Sources of Water Supply of Metropolitan Water District. Boston, Mass., Commonwealth of Mass.—Special Report, House No. 262, 1938, 206 pp., maps and tables. Data on safe yield; results of sanitary survey of Boston water works; proposed extensions; geological features along pressure tunnel; cost of pumping; details of design.

Indianapolis, Ind. Efficiency in Water Service, W. W. DeBerard. *Eng. News-Rec.*, vol. 121, no. 10, Sept. 8, 1938, pp. 302–305. Discussion of operation procedure, maintenance methods, and production control as practiced by Indianapolis Water Company; distribution layout; merchandizing methods.

United States. Status of Municipal Ownership of Water Works in United States. *Am. City*, vol. 53, no. 7, July 1938, pp. 53–54. Abstract of report by Burns & McDonnell, of Kansas City, Mo.; percentage of population by states served by municipally owned water utilities, January 1, 1938; trend towards municipal ownership in United States.

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RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 108 of the Year Book for 1938. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Changing the Skyline, an Autobiography by Paul Starrett. New York, McGraw-Hill Book Co., Whittlesey House, 1938. 319 pp., illus., 10 × 6 in., cloth, $3.

Among the great buildings constructed under Mr. Starrett's guidance are the Flatiron Building; the Pennsylvania Station; the Lincoln Memorial; and the New York Life Insurance Company, McGraw-Hill, and Empire State buildings. His professional life with its difficulties and successes is told, with many anecdotes of men and affairs. In addition to describing an interesting career, the book discusses some of the significant changes in modern cities.

Economics for Engineers, 2 ed. By E. L. Bowers and R. H. Rowntree. New York and London, McGraw-Hill Book Co., 1938. 591 pp., diagrs., charts, tables, 9 × 6 in., cloth, $4.

This is a practical presentation of economic principles for engineers and engineering students, in which the subject is treated as concisely as possible and the engineering aspects of economic theory and business activity are emphasized. This new edition has been entirely rewritten, and several chapters have been added.

Engineering Applications of Aerial and Terrestrial Photogrammetry. By B. B. Talley. New York, Pitman Publishing Corporation, 1938. 620 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth, $10.

In this volume Captain Talley goes at length into the many present-day uses for photogrammetry. Applications to military work, forestry, the U. S. Coast and Geodetic Survey, the Navy's Hydrographic Bureau, topographical work of all kinds, surveys for tax valuation, conservation, development of resources, community development, and other fields make this book of value to both military and civil engineers. Of special interest is the chapter describing the extensive application by the Tennessee Valley Authority.

Estimates and Costs of Construction. By F. W. Stubbs, New York, John Wiley & Sons, 1938. 234 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.

The purpose of this book is to outline some of the important steps in the development of a construction project, especially the preliminary financial investigations and the studies that must be made before and during the actual construction. Only enough cost data to illustrate the discussion are included. There is a bibliography.

Formulas for Stress and Strain. By R. J. Roark. New York and London, McGraw-Hill Book Co., 1938. 326 pp., diagrs., tables, 9 × 6 in., cloth, $3.

The book brings together the formulas, facts, and principles pertaining to the strength of materials which are required in the more precise and accurate methods of stress analysis imposed by modern engineering trends. Part one contains definitions of terms. Part two discusses general principles, methods of stress analysis, and the behavior of material under stress. Part three discusses the behavior of structural elements under various conditions of loading and gives extensive tables of formulas for the calculation of stress, strain, and strength. Numerous lists of references are included. The volume should be a very useful reference book for the designing engineer.

Grundbegriffe und Hauptsätze der Höheren Mathematik. By G. Kowalewski. Berlin, Walter de Gruyter & Co., 1938. 156 pp., diagrs., tables, 9 × 6 in., cloth, 5 rm.

A concise presentation of the fundamentals of higher mathematics, with special attention to the needs of engineers and physicists, by an experienced teacher.

Mechanics of Materials. By P. G. Laurson and W. J. Cox. New York, John Wiley & Sons, 1938. 408 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.75.

The fundamental treatment of general stresses, joints, torsion members, beams, columns, and combined stresses is covered in the first fifteen chapters. The next eight chapters discuss more specialized material, elastic energy, webs, eccentric loading, etc. A large number of problems are included, and various derivations and tables are appended.

Official Map Publications. By W. Thiele under the direction of A. F. Kuhlman. Chicago, American Library Association, 1938. 356 pp. 11 × 7 in., cloth, $4.75.

This handbook is intended primarily as a guide to the map publications that are currently made available by the government mapping services of the different nations. An interesting historical sketch, in which the development of mapping is traced from ancient times to the present century, serves as an introduction. Following this, the mapping services of the United States, Canada, Latin America, and Great Britain, Germany, and other European countries are described and their publications listed. Advice is given on the classification and care of maps, and there is a section on state map publications, and a list of international maps.

Practical Seismology and Seismic Prospecting. By L. D. Leet. New York and London, D. Appleton-Century Co., 1938. 430 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $6.

The first four chapters are devoted to a comprehensive discussion of earthquake phenomena, the laws governing the propagation of elastic waves in the materials of the earth, and the instruments and methods for recording vibrations. The last chapter describes the commercial and scientific use of elastic vibrations to investigate rock structures. There is a list of patents.

Text Book of Applied Hydraulics, 2 ed., revised and enlarged. By H. Addison. New York, John Wiley & Sons, 1938. 435 pp., illus., diagrs., charts, tables, 9 × 6 in. cloth, $5.50.

A compact summary of the fundamental principles of hydraulics, and of the manner in which they are applied by the engineer, this book is intended particularly for readers whose work is not directly connected with hydraulics, but who need to know the main outlines of hydraulic practice. Two-thirds of the text is devoted to turbines, pumps, hydraulic transmissions, and other practical applications. The new edition has been revised and slightly enlarged.

Welded Steel Construction. By Robert S. Hale. New York, Pitman Publishing Corporation, 1938. 170 pp., illus., tables, diagrs., charts, 8½ × 5¼ in., cloth, $3.

This book gives a simple, concise exposition for architects, engineers, fabricators, contractors, welders, estimators, students, and others who have a general knowledge of plans and structural engineering or welding. A number of reference tables and graphs are included as well as the welding portions of the New York City and Chicago building codes and the American Welding Society's Specifications for Highway and Railway Bridges by Fusion Welding.

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UNITED STATES STEEL

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

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BRIDGES

Africa. La construction de Cinq Ponts-Route en béton à la Cote d'Ivoire, J. Prunet. *Génie Civil*, vol. 113, no. 2925, Sept. 3, 1938, pp. 197–200. Design and construction of five concrete arch and concrete girder highway bridges recently completed in French Ivory Coast Colony, West Africa; maximum arch span 45 m; maximum total length 252 m.

Concrete Arch, Germany. Die Rohrbachbruecke Bei Stuttgart, Klett and Rietli. *Beton u Eisen*, vol. 37, no. 5, Mar. 5, 1938, pp. 77–87. Design and construction of Rohrbach highway concrete bridge, near Stuttgart, Germany, consisting of 7 thick arch spans ranging in length from 27.4 to 44.5 m.

Concrete Arch, Spain. Esla Viaduct, Spain. *Engineer*, vol. 166, no. 4308, Aug. 5, 1938, pp. 147–148 and 150. Illustrated description of large reinforced concrete railway bridge being built on line between Zamora and Corunna in Spain; it includes reinforced concrete central arch with span exceeding that of two largest existing concrete arches; deck designed to carry double railway track; total length of viaduct 1,640 ft; main arch has real span of 672 ft and rise of 197 ft.

Concrete, California. Box-Girder Bridge Used on Federal Aid Feeder Road. *Western Construction News*, vol. 13, no. 9, Sept. 1938, pp. 330–331. Design of proposed box-girder concrete bridge over Eel River in northern California, consisting of 3 spans 84.5 to 95 ft in length.

Concrete, Germany. Eisenbetonbruecken der Deutschen Alpenstrasse, R. Albrecht. *Zement*, vol. 27, no. 1, Jan. 6, 1938, pp. 7–9. Reinforced concrete bridges of German Alpine highway; brief illustrated description.

Concrete Slab, Binghamton, N.Y. These Flat-Slab Concrete Bridges Embody Unusual Features, A. B. Cohen. *Ry. Age*, vol. 105, no. 13, Sept. 24, 1938, pp. 443–447. Construction of parallel structures on Erie and Lackawanna Railroads involved use of unique detour trestle by both roads; construction of under crossings comprised integral part of larger project which involved building of 3-span reinforced concrete highway bridge to carry Ferry Street across Chenango River to replace through-girder steel structure washed away during flood of July 1935.

Floors. Berichte des Beutschen Ausschusses fuer Stahlbau, Ausgabe B, Heft 9: Aus Untersuchungen mit Leichtfahrbarndecken zu Stressenbruecken, O. Graf. Berlin, Julius Springer, 1938. 25 pp., illus., diagrs., charts, tables, 4 rm. Report gives results of tests of number of types of light steel floors for highway bridges. Eng. Soc. Lib., New York.

Floors. Bridge Decks of Composite Timber-Concrete Construction, J. Tate. *Eng. & Contract. Rec.*, vol. 50, no. 92, Sept. 29, 1937, pp. 7–9. Description of highway under construction at Port Arthur, Ontario, featuring pressure-creosoted timber and concrete keyed at plane of contact so as to act in complete unison.

Floors. Schrumpf- und Temperaturspannungen in Brueckentraegern mit aufgeschweisstem Tonnenblech-Belag, T. Schwarz. *Mitteilungen aus den Forschungsanstalten GHH-Konzern*, vol. 6, no. 4, May 1938, pp. 117–122. Theoretical and experimental study of effect of shrinkage and temperature stresses in sheet steel flooring welded onto bridge girders.

Military. New Foot Bridge Equipment, J. M. Young. *Military Engr.*, vol. 29, no. 168, Nov.–Dec. 1937, pp. 407–410. Features of Lampert and kapok types of military foot bridge; description of new type of foot bridge, developed by The Engineer Board since 1932 and capable of crossing 100 men over lengths from 100 to 300 ft; flooring and other details; assembling and launching.

Plate Girder, Denmark. Le pont sur le Storstrom, A. Engelund. *Ossature Métallique*, vol. 6, no. 12, Dec. 1937, pp. 567–573. Design and construction of plate girder and steel arch Storstrom Bridge, Denmark. Similar in contents to several articles previously indexed from various sources.

Bascule, Denmark. Le nouveau pont mobile "Knippe Isbro," a Copenhague, C. A. G. Scheel. *Technique des Travaux*, vol. 14, no. 3, Mar. 1938, pp. 153–163. Design and construction of 2-leaf bascule bridge Knippe Isbro, at Copenhagen, Denmark, having span of 35 m and width of 27 m, including sidewalks.

Pontoon. Concrete Pontoon Bridge to Solve Washington Highway Location Problem, L. V. Murrow. *Western Construction News*, vol. 13, no. 7, July 1938, pp 249–252. Proposed unique design of highway pontoon bridge 8,571 ft long involving use of reinforced concrete barges 309 ft long to support 44-ft width of highway across Lake Washington on east side of Seattle, Wash.; estimated cost $4,653,000.

Vierendeel. Poutres Vierendeel en porte-à-faux, L. Baes. *Ossature Métallique*, vol. 6, nos. 9 and 12, Sept. 1937, pp. 427–443, and Dec., pp. 591–604. Application of theoretical analysis of stresses in overhanging Vierendeel trusses, including bridge trestles, out of plumb; photoelastic tests of models of such structures.

Wooden. Composite Laminated Creosoted Timber Deck. *Eng. & Contract. Rec.*, vol. 50, no. 94, Oct. 13, 1937, pp. 9–11. Description of trans-Canada highway bridge near Haig, B.C.; 484 ft long; designed for H-15 loading; contains 23 creosoted timber spans.

BUILDINGS

Air Conditioning, Office Buildings. With No Windows Air Conditioning Must Be Good, J. H. Walker. *Heating & Vent.*, vol. 35, no. 8, Aug. 1938, pp. 13–16. Detroit Edison Company building uses glass brick completely replacing windows; problems encountered in use of glass brick; lighting system described; simplified diagram of air-conditioning system given.

Steel, Design. Design of Steel Buildings, 2 ed, H. D. Hauf. New York, John Wiley & Sons, 1938. 232 pp., diagrs., charts, tables, $2.75. General principles of structural steel design as applied to commoner types of buildings, with consideration of various structural units, elements, and stresses which enter into such work. Eng. Soc. Lib., New York.

Welded Steel Structures. Structural Welding Advances Under New York City Code. *Eng. News-Rec.*, vol. 121, no. 11, Sept. 15, 1938, pp. 325–326. Construction of large steel-frame welded buildings, up to 14 stories in height, under New York City code.

World's Fair, New York City. New York World's Fair 1939. *Eng. News-Rec.*, vol. 121, no. 12, Sept. 22, 1938, pp. 350–384. Symposium including following papers: Its Background and Objective, W. E. Andrews; Preparation of Fair Site, C. S. Proctor; Adapting Plans to Site, S. F. Voorhees; Construction Organization and Technique, J. P. Hogan; Foundations on Deep Fill, H. A. Foster and G. W. Glick; Landscape Plan for Fair, G. D. Clarke; Design of Exhibit Buildings, R. H. Shreve; Water, Sewers, and Services, L. B. Roberts; Roads for Fair and Park, H. W. Durham; and Transport for Fifty Million Visitors, H. M. Brinckerhoff.

CITY AND REGIONAL PLANNING

Cleveland, Ohio. Cleveland . . . Metropolis of the Western Reserve. *Arch. Rec.*, vol. 84, no. 3, Sept. 1938, pp. 64–78. Symposium consisting of following: Historical Background, I Frary; Growth of Regional Planning, A. Garfield; Cleveland's Slum-Clearance Housing and Cultural Buildings, W. McCornack; Cleveland's Industrial Areas, W. J. Watson; Residential Development of Western Reserve, T. G. Walsh.

CONCRETE

Coloring. Color Analysis of Portland Cement Concrete, W. M. Dunagan. *Iowa State College–Eng. Experiment Station—Bull. 139*, vol. 36, no. 42, Mar. 16, 1938, 39 pp. Application of Razek-Mulder color analyzer, or automatic spectrophotometer to study of color of portland cement and concrete; effects of moisture curing, and age on color of concrete; changes in color of concretes associated with nature of hardening of portland cement.

Construction. Huge Industrial Building of Concrete at Remarkably Low Cost. Concrete, vol. 46, no. 10, Oct. 1938, pp. 3–4. Monolithic reinforced concrete structure has barrel-shell roof construction; contract based on average of four low bidders was $1 per sq ft usable space; construction details.

Construction, Pre-Stressing. Moeglichkeiten des Eiseneinsparens, E. M. Kilgus. *Zement*, vol. 27, no. 2, Jan. 13, 1938, pp. 26–28. Possibilities of saving of steel in reinforced concrete construction; reference to Freyssinet method of pre-stressing of reinforcement, pointing out resulting economy in use of steel.

Construction, Pump Placing. Subzero Concrete Pumping, F. A. Dale. *Eng. News-Rec.*, vol. 121, no 13, Sept. 29, 1938, pp. 407–409. Methods used in pump placement of concrete during winter at Solon Dam on Kennebec River in northern Maine with temperatures as low as −20 F; anti-cold measures.

Construction, Vibration. Measurement of Vibration in Fresh Concrete, G. L. Pigman, F. B. Hornibrook, and J. S. Rogers. *Engineering*, vol. 146, no. 3788, Aug. 19, 1938, pp. 232–233. Abstract of paper previously indexed from *U. S. Bur. Standards—J. Research*, May 1938.

Curing. Fundamentals of Curing, P. M. Woodworth. *Concrete*, vol. 46, no. 9, Sept. 1938, pp. 6 and 27. Paper deals specifically with curing of cinder concrete building units, but most processes described are applicable to concrete of all kinds. Before Nat. Cinder Concrete Products Assn.

Disintegration. Resistance of Cements to Attack by Sea Water and by Alkali Soils, T. E. Stanton Jr. and L. C. Meder. *Am. Concrete Inst.—Proc.*, vol. 34, 1938, pp. 464–469. Discussion by L. H. Tuthill and B. E. Nutter of paper previously indexed from Journal, Mar.-Apr. 1938; authors' closure.

Earth, Design. Instructions for Design and Construction of Small Dams, L. C. Tschudy and J. G. Sutton. *Pub. Works*, vol. 68, no. 8, Aug. 1937, pp. 21–24. Determination of spillway capacity; freeboard; construction of spillway; design of masonry overflow dams; preparation of foundation and construction of dam; timber crib dams.

Floors. Les Planchers—Champignons, A. Moser. *Technique des Travaux*, vol. 14, no. 3, Mar. 1938, pp 137–152. Theory of design of reinforced concrete mushroom floor systems; recent European examples of this type of construction.

Houses. Gestaltung eines Wohnhauses aus Beton, etc., M. Rudel. *Zement*, vol. 27, no. 2, Jan. 13, 1938, pp. 23–26. Design of concrete dwelling house from viewpoint of heat and sound insulation and weathering; illustrated description of 4 family house designed by author; cost comparison with brick construction.

Hydraulic Fill, Failure. Slide at Fort Peck Dam Moves Eight Million Yards of Fill. *Eng. News-Rec.*, vol. 121, no. 13, Sept. 29, 1938, pp. 385 and 389. First brief report on partial failure of upstream face of Fort Peck Dam on Sept. 21, which carried out some 8,000,000 cu yd of hydraulic fill, released waters from 9,000-ft core pool, and buried eight men.

Mixing. Grading Concrete Aggregates, H. N. Walsh. *Concrete & Constr. Eng.*, vol. 33, nos. 8 and 9, Aug. 1938, pp. 421–432, and Sept., pp. 471–480. Aug: Results of experimental studies for determining grading of aggregates to make dense and workable concrete; effects of

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When in doubt as to the right asphalt product for any purpose get in touch with a Standard Oil Asphalt representative. Call the local office or write 910 S. Michigan Ave., Chicago, Ill.

• RUST PROOFING METAL. Tanks, beams, metal roofs and many other metal surfaces exposed to corrosion may be protected with an asphalt coating applied cold. It combines the extra protection of asphalt with the convenience of brush application.

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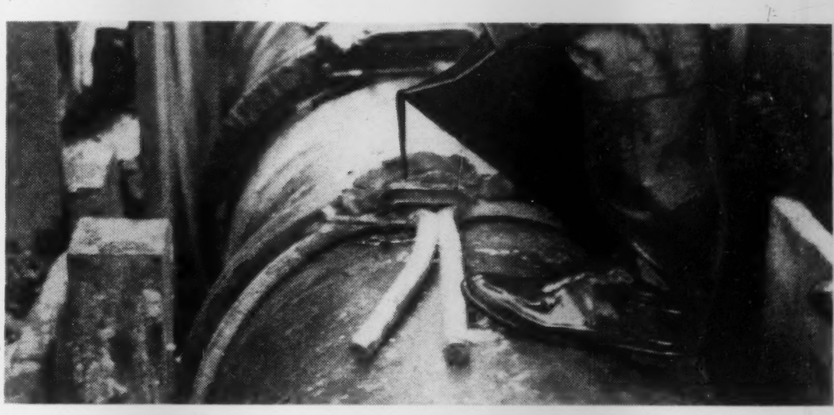

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Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

New A-C Tractor

A NEW GASOLINE tractor, the Model "S," has been announced by Allis-Chalmers Manufacturing Co. This new machine is much the same in appearance and performance as the Model "S-O" Controlled Ignition Oil Tractor.

The Model "S" develops 77.66 HP on the belt, 64.52 HP at the drawbar and 16,732 lbs drawbar pull in first gear. The constant mesh transmission provides five forward speeds from 1.52 to 6.37 mph and the constant mesh feature makes it possible to shift "on the go" like a truck. The tractor is offered in two tread widths. The 62 in. tread model has a shipping weight of 18,200 lbs while the 74 in. tread machine weighs 19,000 lbs.

A new four cylinder valve-in-head gasoline engine has been developed by Allis-Chalmers for the Model "S." The bore is $5^{3}/_{4}$ in., the stroke $6^{1}/_{2}$ in., and the governed speed at full load is 1050 R.P.M. Like all other Allis-Chalmers engines it has removable cylinder lining and inserted valve seats. The most remarkable feature of this new engine, however, is its fuel economy as tests show a fuel consumption of only 0.5 lb per brake hp hour at 80% to 90% of full load for continuous service. The Model "S" is ideally suited for snowplow work, for 7 to 8 yd scrapers, 12 ft blade graders, 10 yd wagons, bulldozers, trail-builders, winches, or other auxiliary equipment. A folder describing this new tractor may be obtained from the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

A New J-M Acoustical Product

TO MEET THE NEED for an acoustical product that fulfills every requisite of acoustical quality and at the same time is distinguished in appearance and character, the Johns-Manville Acoustical Research Laboratories have developed a new ceramic tile known as "Permacoustic." Formed from a combination of rock wool and clay, which is baked at an extremely high temperature, Permacoustic has a warm, pleasing light cream color with an interesting, finely-grained surface texture. Permacoustic is especially adaptable in monumental buildings where a high degree of sound absorption is required. Its stone-like properties fit admirably into the various architectural designs where masonry interior surfaces form the room finish, as in lobbies of schools, public buildings, and auditoriums. The new product is furnished 1 in. thick in sizes 12 in. × 12 in., 9 in. × 9 in., and 9 in. × 18 in., combinations of which permit a wide variety of patterns. The exposed edges have a $^{1}/_{8}$ in. bevel.

Electrode for Cast Iron

A HEAVILY COATED shielded arc electrode called "Softweld," and designed for depositing a soft machineable alloy on cast iron, has been produced by Lincoln Electric Co., Cleveland, Ohio. This new electrode is intended for use in correcting machining errors or in filling up defects in grey cast iron. It is available in $^{5}/_{32}''$ × 16″ only, packed in five pound containers.

Chain Belt Conveyors

CHAIN BELT COMPANY of Milwaukee has announced the addition of a complete new line of screw conveyors and steel buckets, made possible by the acquisition of the machinery and drawings of the Weller Mfg. Company, Chicago. The addition of the complete line of screw conveyors and steel buckets furthers the scope of application of the chain and conveyors made by Chain Belt Company. The company now produces a wide range of conveyors.

Street Lighting Relay

A NEW LOW-PRICED photoelectric relay to control the operation of street lights has been announced by the General Electric Company. The new relay, employing the same principles as former relays to turn the lights on or off when nature's level of illumination drops below or rises above a predetermined level, is available at a price less than half that of previous photoelectric relays. The new relay comes in a compact housing about one-eighth the size of former equipment and weighs but 10 lbs.

A separate holder for the controlling element, the phototube, is available to enable the installation of this tube far above the ground, away from stray light and shadows of nearby objects. The relay box then can be located within the service man's reach.

Portable Barco Drill

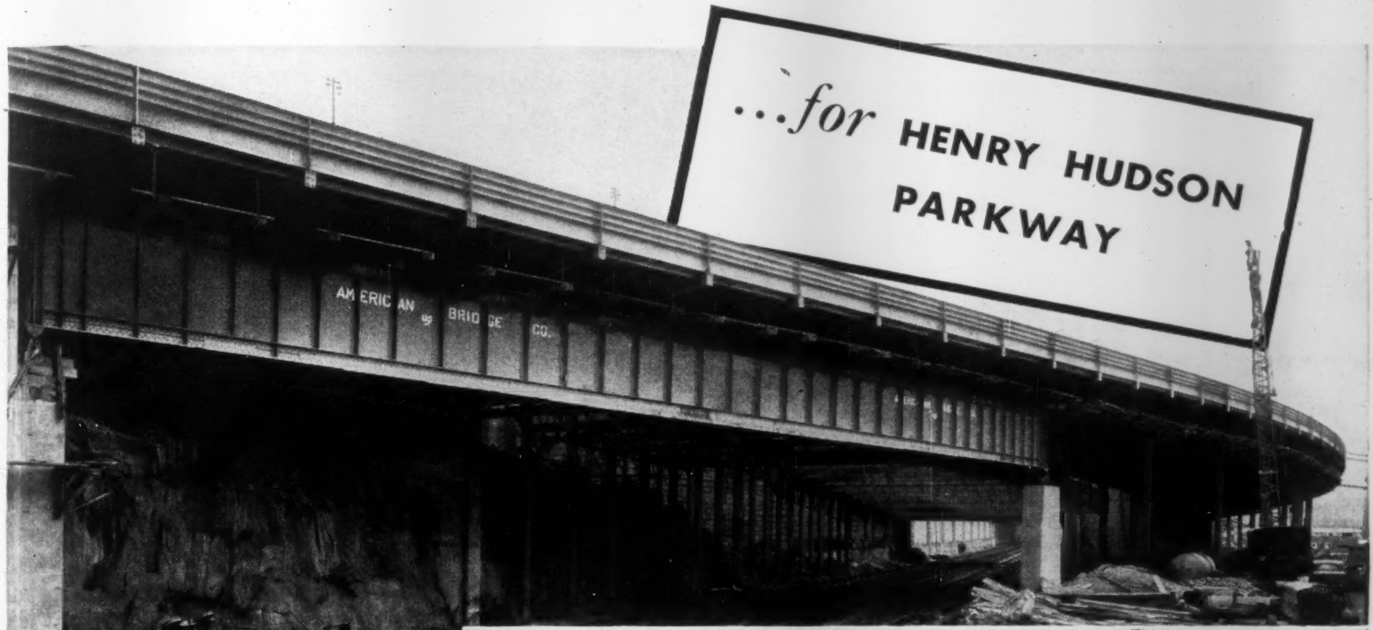
FOLLOWING EXHAUSTIVE tests on actual drilling operations conducted on all types of jobs and under a wide variety of working conditions, the Barco Manufacturing Co. of Chicago, Ill., announce their newly designed, self-powered, instantly portable driller known as the "BARCO J-2."

The former drilling equipment manufactured by Barco consisted of a drilling swivel applied as an accessory tool to the BARCO Hammer. The J-2 is designed as a driller, incorporating the drill-turning mechanism directly in the base of the power unit. Thus it is able to strike a full, direct blow, delivering all its power at the drill head, operating at the minimum of cost.

A ratchet wrench for turning the drill rod is standard equipment with the J-2, and, if the user desires to eliminate hand spooning or flushing of the hole, a small portable air compressor unit, necessary storage tank and fittings, is available. Literature regarding this new driller may be obtained from the manufacturer.

Record Single-Span Girder

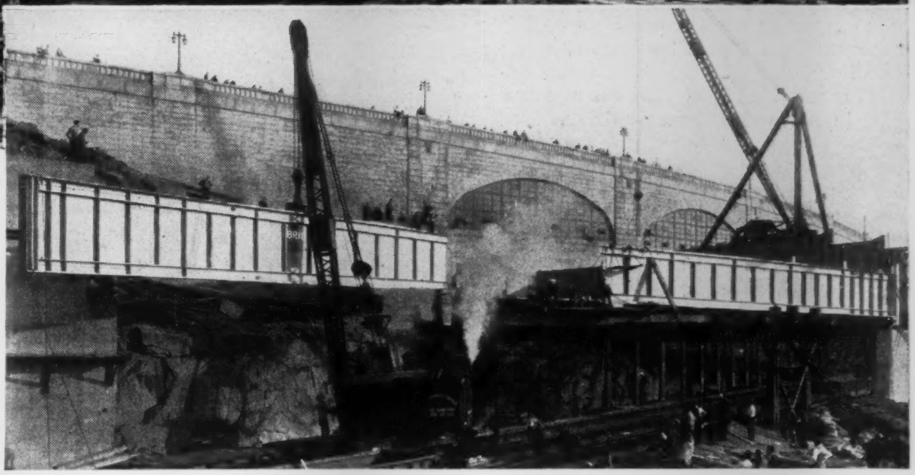
...*for* HENRY HUDSON PARKWAY



THE WEST SIDE IMPROVEMENT. Robert Moses, Comm. of Parks. Designing and Supervising Engineers: Madigan-Hyland and New York Central Engineering Department.

• • •

(Above) *Viaduct crossing over New York Central tracks at 160th Street. Plate girder span 188 ft. 2¾ in., between centers of end bearings. Overall length 190 ft. 2 in. Depth 10 ft. 7 in.*



(Above) *Girder was fabricated and shipped in two sections. Field splice was made with abutting ends supported on a falsework bent which spanned the tracks, thus avoiding any interruption to traffic.*

AUTOMOBILISTS spinning over the new Henry Hudson Parkway in New York City, enjoying the unobstructed view of the majestic Hudson River, are probably unaware when crossing the New York Central Railroad tracks at West 160th Street that they are passing over the longest single-span plate girder in America. It is, however, an item of special interest to engineers because of its design and construction.

That section of the Parkway viaduct at this point swings clear of and crosses the 5-track right-of-way. The carrying girder on the west face, constructed of silicon steel, has an over-all length of 190 feet, 2 inches, and weighs approximately 152 tons. No companion girder was required on the east, the transverse floor beams being supported by columns along the east right-of-way line.

American Bridge Company, as subcontractors, participated extensively in the steel requirements for the entire Parkway project. It supplied fabricated steel for some three miles of specialized subway and viaduct structures, the greater portion of which they also erected over the busy, electrified New York Central tracks with minimum traffic interruption.

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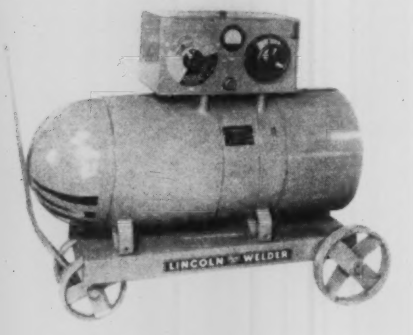
UNITED STATES STEEL

Shield-Arc Welders

A LINE OF "Shield-Arc" Welders, said to provide greater convenience and accuracy because of a new self-indicating dual continuous control, is announced by The Lincoln Electric Co., P. O. Box 5758, Cleveland, Ohio.



Special features of this new line of Lincoln welders include: both job selector and current control calibrated and equipped with dials which indicate the type of work and the number of amperes for each setting; continuous operation of both voltage control and current control; a self-protected motor on all AC driven welders; separate excitation of the welding generator in all types; laminated magnetic circuits.

This new line of Lincoln welders is available in AC and DC motor driven types, belted or coupled type, and in gasoline engine and Diesel engine driven types, in all standard ratings. A well illustrated and comprehensive 20-page booklet, printed in two colors, gives the story of the arc welding technique made available by the Lincoln "Shield-Arc" Welder.

New pH Slide Comparator

A NEW Slide Comparator for the colorimetric determination of pH, chlorine and phosphates has been developed by W. A. Taylor & Co., 872 Linden Ave., Baltimore, Md.

The new Comparator consists of a slide and a base. Each slide, which is 10 in. long, $2^{1}/_{8}$ in. wide and 4 in. high, contains nine standards alternating with ampoules of distilled water. All color standards are guaranteed by the manufacturer to maintain their accuracy for a period of five years. The base contains two vials of indicator solution, with 0.5 cc pipettes, 5–5 cc test tubes, and a piece of etched glass in a special compartment. Determinations are made by filling three of the test tubes with the test sample, adding 0.5 cc of indicator solution to the middle one, placing the slide on the base and moving it back and forth until the test sample matches one of the color standards. The pH, chlorine, or phosphate values is then read off directly from the values on the slide.

One base can be used with any number of color standard slides. Full information on these outfits can be obtained from the manufacturer.

New Marion Shovel

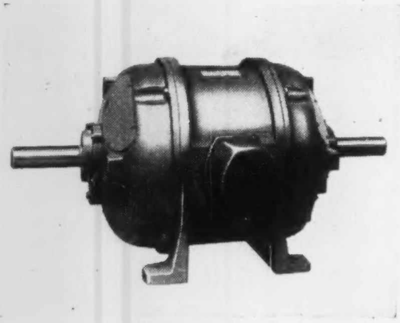
THREE NEW FEATURES which meet modern digging requirements are incorporated in the new Marion Type 352 excavator of $1^{1}/_{4}$ cu yd capacity, recently built by the Marion Steam Shovel Co., Marion, Ohio.

These new Marion features are: velvo-grip hoist and crowd clutches; vacuum controlled dipper trip, and vacuum controlled rotating clutches. The velvo-grip hoist and crowd clutches enable the operator to have the "feel of clutch" at all times, assuring smooth handling and accurate spotting of loads. With the vacuum controlled dipper trip the shovel operator can trip the dipper without removing his hand from the main lever, for the control valve is mounted on the main lever. This promises speedier and easier operation. A single lever at the operator's station opens and closes vacuum valves controlling the rotating clutches, which are of the cone type. The rotating clutch shaft is mounted on anti-friction bearings. Bevel gears are enclosed in a cast-steel oil-tight case.

In addition to the features already enumerated, the Type 352 Marion provides self-cleaning, non-clogging crawlers, independent chain crowd, and many other Marion developments. Easily convertible into a crane, clamshell or pull shovel, the Type 352 is powered by gas, Diesel or electric motors. Under ordinary working conditions travel speed is nearly a mile an hour, and rotating speed is 3.74 complete revolutions a minute.

Hoist Motors

TYPE CS HOIST motors, designed for severe intermittent service where frequent starts, stops and reversals are encountered, and especially applicable for hoist service and as door and gate valve operators, are announced by Westinghouse Electric & Manufacturing Co.



The high resistance rotor provides the highest ratio of starting torque to starting current obtainable with a squirrel-cage motor. They cause minimum disturbance to the line and permit the use of a low cost full voltage starter on the majority of installations. They handle light loads quickly while heavier loads cause the speed to decrease with a corresponding increase in torque. The frame is cast in one solid piece with feet cast integral providing an exceptionally strong rigid design especially suited to withstand heavy overloads and frequent reversals without distortion.

Literature Available

DIESEL—A forty-page bulletin on Type "S" Diesel engines has just been published by Ingersoll-Rand Co., 11 Broadway, New York, N. Y. This machine is a heavy-duty, continuous-service, compact engine for stationary or marine-electric application; built in sizes of 3, 4, 5, 6, 7 and 8 cylinders, and rated at 175, 230, 290, 350, 405 and 460 BHP for 600 rpm.

FEREC IRON REMOVAL FILTERS—is the subject of a new bulletin on the removal of iron minerals from water by catalytic filtration Soluble and insoluble iron are selectively removed. Wm. B. Scaife and Sons Co., Oakmont, Penna.

FLOOR ARMORING—A series of booklets describe the application, in various industrial plants, of the cast gray iron Armor Grids manufactured by Snead & Company, 126 Pine St., Jersey City, N. J.

INCONEL—Technical Bulletin T-7, "Properties and Uses of Inconel," has been recently revised and extensively rewritten. It covers the general properties, corrosion resistance, working properties and typical uses of this alloy. The International Nickel Co., Inc., 67 Wall St., New York, N. Y.

PILING—STEEL SHEET—Bethlehem Steel Sheet Piling sections, and fabricated piling units are fully described, illustrated and diagrammed in the 24 pages of Catalog No. 151. Bethlehem Steel Company, Bethlehem, Penna.

PIPE—A new 10-page pamphlet, entitled "Facts about Republic Standard Pipe," containing bundling tables, sizes and weights, identification and corrosion information on Republic standard, copper-bearing steel pipes and Toncan copper molybdenum iron pipe, has been issued by Republic Steel Corp., Cleveland, Ohio.

PURIFIER—Hydrodarco Purifiers for removing objectionable tastes and odors from water are described in Bulletin No. 1700, issued by International Filter Co., 59 E. Van Buren St., Chicago, Ill. Hydrodarco Purifiers are completely automatic units in various sizes and types.

STEEL SHEETS—Strip and Roofing. A spiral wire-bound handbook, Catalog No. 145, interestingly describes the methods of rolling Bethlehem Sheets and catalogs sheets, strip, and roofing products. Bethlehem Steel Co., Bethlehem, Penna.

SWIMMING POOL STERILIZATION—The use of sodium hypochlorite, produced in a "Safety Electric Sterilizer," from rock salt and water, is described in an eight-page folder. Everson Mfg. Co., Chicago, Ill.

TRACTORS—The economies, advantages and capacities of the "Caterpillar" Diesel D4 Tractor are set forth in a new 32-page booklet, Form 4870. Cutaway photographs in two colors show the principles of the tractor's Diesel engine, its fuel system, operation, etc. Separate chapters cover the transmission, final drive and tracks. Caterpillar Tractor Co., Peoria, Ill.

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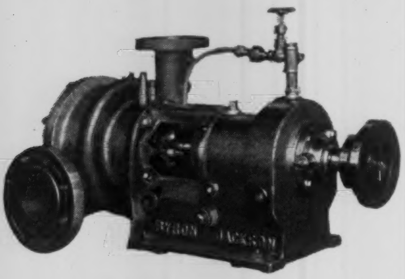

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Plants, Michigan. How This Ready-Mixed Plant Supplies Warm Concrete. *Concrete*, vol. 46, no. 9, Sept. 1938, p. 14. Practice at Grand Rapids Gravel Company, which is equipped for heating both aggregates and mixing water, and to supply calcium chloride in solution if required by specifications of mix; cold-weather operation described.

Railroad Maintenance of Way. Concrete Sub-Ballast Slabs Stabilize Railway Fill. *Concrete*, vol. 46, no. 7, July 1938, pp. 5 and 27. Missouri-Pacific ends settlement of fill on soft bottom land at Jones Ridge, Ill.; design of slabs and method of placing them discussed.

Retaining Walls. Die Gitterwandstuetzmauer am Reichsarchiv in Potsdam, A. Schroeter. *Zement*, vol. 27, no. 17, Apr. 28, 1938, pp. 264–267. Trellis work retaining wall; description of new patented type of retaining wall and example of its use in Reichsarchiv in Potsdam, Germany; it is claimed to possess greater stability combined with saving in material and work.

Viaducts. Cincinnati Builds Traffic Express Route to Reach Business District. *Concrete*, vol. 46, no. 9, Oct. 1938, pp. 3–4. Columbus Avenue viaduct is major structure at business-district end of project; truck mixers and pumpcrete utilized in placing concrete; other construction practices discussed.

DAMS

Concrete Gravity, Washington. Work Resumed at Grand Coulee with Reconditioning of Plant. *Western Construction News*, vol. 13, no. 7, July 1938, pp. 275–278. Progress report on construction of Grand Coulee concrete gravity dam; rehabilitation of aggregate production system, dismantling of old concrete, placing trestles, moving mixing plants and improving camp; concrete placing cranes; penstock fabrication.

Concrete, United States. Leistungen und Baueinrichtungen bei amerikanischen Sperrmauern und Staudaemmen. G. Garbotz. *Beton u Eisen*, vol. 37, no. 3, Feb. 5, 1938, pp. 48–52. Tabulated design and construction features of large American concrete dams built since 1930.

Earth, California. Bids Called—Prado Dam to Involve 3,130,000 Cu Yd of Rolled Earthfill. *Western Construction News*, vol. 13, no. 9, Sept. 1938, pp. 326–327. Principal features of proposed Prado earth-fill dam, near Los Angeles, Calif.; 105 ft maximum height; 2,280 ft long.

Earth, California. Contractor Rushes Fill Operations to Complete Boca Dam This Season. *Western Construction News*, vol. 13, no. 9, Sept. 1938, pp. 335–338. Progress report on construction of Boca earth-fill dam, California; 110 ft maximum height; 1,650 ft length; construction equipment; spillway of 8,000 cu ft per sec capacity will control flood flows through two 19 by 16-ft radial gates; principal unit bids; labor problems.

France. Meilensteine des Fortschritts im Franzoesischen Talsperrenbau, F. Toelke. *Bauingenieur*, vol. 19, no. 7/8, Feb. 18, 1938, pp. 115–120. Review of latest French practice in construction of rock-fill, concrete-arch, and multiple-arch dams in France and in French colonies in North Africa.

FLOOD CONTROL

Hydraulic Gates, Welding. Welding Facilitates Fabrication of Flood Gates, C. H. Jennings. *Iron Age*, vol. 141, no. 24, June 16, 1938, pp. 36–37 and 93. Brief discussion of application of arc welding in design and construction of $600,000 flood-control project across Turtle Creek just below East Pittsburgh works of Westinghouse Elec. & Mfg. Co.

Streams, Regulations. Regelung kleinerer Wasserlaeufe, C. Keutner. *Bauingenieur*, vol. 19, no. 11/12, Mar. 18, 1938, pp. 168–182. Regulation of small streams by construction of check dams and similar structures; review of German practice.

FLOW OF FLUIDS

Flow of Water, Underground. Formules Relatives à l'hydraulique souterraine, E. Lefranc. *Génie Civil*, vol. 113, no. 2923, Aug. 20, 1938, pp. 162–166. Theoretical mathematical discussion of laws of flow of water through underground formations, including cases of vertical and radial percolation through artesian strata.

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Caissons, Pneumatic. Neuere Druckluftgruendungen in Oder und Rhein, H. Weber. *Beton u Eisen*, vol. 37, no. 4, Feb. 20, 1938, pp. 57–61. Examples of construction of large concrete pneumatic caissons used in construction of bridge piers and diversion dams on Oder and Rhine rivers, Germany.

Soils, Testing. Simple Subsoil Sampler, E. C. Seibert. *Eng. News-Rec.*, vol. 121, no. 4, July 28, 1938, p. 121. Description of soil sampler, developed at Naval Air Station, Alameda, Calif., for securing samples of soft and loose materials at depths of about 20 ft.

HYDRAULIC ENGINEERING

Hydraulic Laboratories, Switzerland. Hydraulic Laboratory of Federal Institute of Technology, Zurich. *Engineering*, vol. 146, nos. 3781 and 3786, July 1, 1938, pp. 3–5, and Aug. 5, pp. 149–151, supp. plates. Illustrated description of design, equipment, and work of laboratory.

Hydrodynamics. Forces on Two Spheres Placed in Uniform Flow, D. Endo. *Physico-Mathematical Soc. Japan—Proc.*, vol. 20, no. 8, 3d series, Aug. 1938, pp. 667–703. Velocity potential for flow past two fixed solids spheres is found in terms of bipolar coordinates in three dimensions; most of results are quite similar to case of two circular cylinders except magnitude of limiting critical angle; integral formulas used in text given in appendix as well as tables of Legendre functions and their derivatives. (In English.)

Models. Model Experiments and Design of Boulder Dam. *Engineering*, vol. 146, no. 3781, July 1, 1938, pp. 15–16. Editorial review of bulletins being prepared by U. S. Department of Interior as comprehensive series of Final Reports on Boulder Canyon Project, as follows: Bul. 1, Part VI: Model Studies of Spillways; Bul. 2, Part VI: Model Studies of Penstocks and Outlet Works.

HYDROLOGY AND METEOROLOGY

Earthquakes. Studies of Periodicity of Earthquakes, C. Davison. London, Thomas Murby & Co., 1938, 107 pp., charts, tables, 13s 6d. Author has summarized and thoroughly revised various articles on periodicity of earthquakes which he has published during period of 40 years; bearing of these studies upon movements of earth's crust discussed. Eng. Soc. Lib., New York.

Hurricanes, United States. Northeastern Gale and Flood. *Eng. News-Rec.*, vol. 121, no. 14, Oct. 6, 1938, pp. 424–430. Symposium on unprecedented tropical hurricane which swept Long Island and New England states on Sept. 21, 1938, including following articles: Water and Wind on Shore, H. W. Richardson; Floods in River Valleys, W. G. Bowman.

Hydrologic Problems. Application of Meteorology to Hydrologic Problems, W. R. Gregg. *Military Engr.*, vol. 29, no. 168, Nov.-Dec. 1937, pp. 425–427. Application of meteorology to forecasting of floods; Ohio flood of 1937; progress in forecasting weather; long-range forecasting.

IRRIGATION

California. Central Valley Project of California, E. Hyatt. *Am. Water Works Assn.—J.*, vol. 30, no. 3, Mar. 1938, pp. 389–401. Planning of development of water resources of California with special reference to Central Valley Project now in course of construction.

Canals, Construction. Mechanized Operations Featured in Contractors' Work on Roza Canals. *Western Construction News*, vol. 13, no. 8, Aug. 1938, pp. 296–300. Description of "assembly line" type of procedure with especially designed machines used in building large capacity concrete-lined canals for irrigation project in Washington; rough excavation backfilled with compacted earth and trimmed to grade for concreting.

Egypt. La diminution de fertilité dans la vallée du Nil due à l'excès d'irrigation déterminé par les grands barrages. *Génie Civil*, vol. 113, no. 2923, Aug. 20, 1938, pp. 169–170. Observations on decrease of fertility of Nile Valley due to waterlogging of irrigated lands caused by rise in water table due to construction of Nile dams.

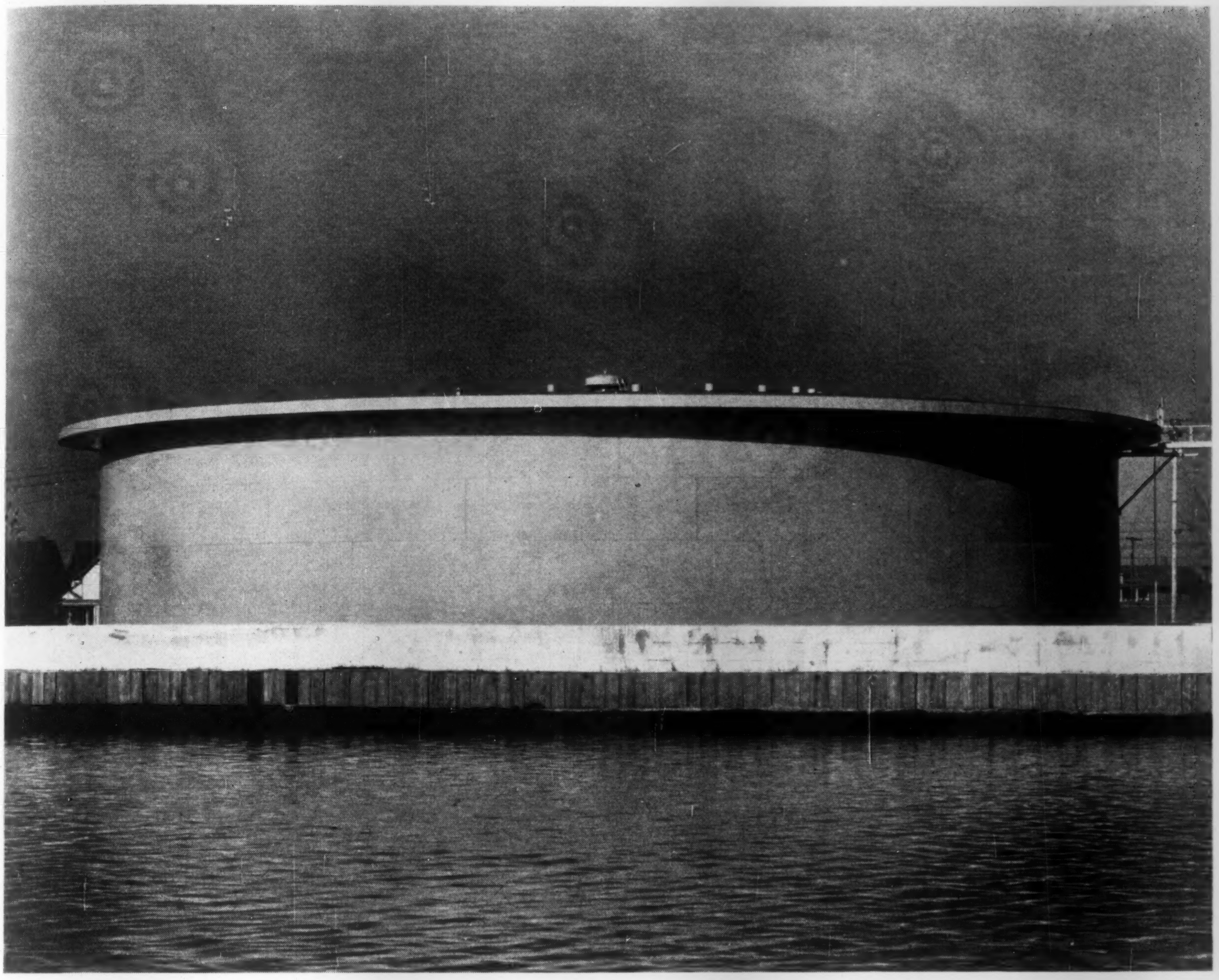
Washington. General Features of Roza Project. A $15,000,000 Irrigation Development. *Western Construction News*, vol. 13, no. 7, July 1938, pp. 256–258. Outline of design and construction of final division of Yakima Valley Project, Washington, involving 26 miles of canal, $3^1/_2$ miles of tunnel, and diversion dam 300 ft long and about 45 ft high.

MATERIALS TESTING

Building Materials. Cementitious, Ceramic, Concrete, and Masonry Materials. *Am. Soc. Testing Matls.—Proc.*, vol. 37, pt. 1, 1937, pp. 273–338. Reports of committees on cement, brick, fire tests of materials and construction, refractories, concrete and concrete aggregates, hollow masonry building units, gypsum, and concrete pipe; Study of Plastic Mortar Cubes, H. W. Leavitt.

Building Materials. Cementitious, Ceramic Concrete, and Masonry Materials. *Am. Soc. Testing Matls.—Proc.*, vol. 37, pt. 1, 1937, pp. 717–809 and 918–923. Tentative specifications for cement, masonry building units, fire brick refractories, and concrete and concrete aggregates.

Concrete Aggregates. Simple Sand Moisture Test, S. S. Green. *Eng. News-Rec.*, vol. 121, no. 13, Sept. 29, 1938, pp. 414–415. Simple



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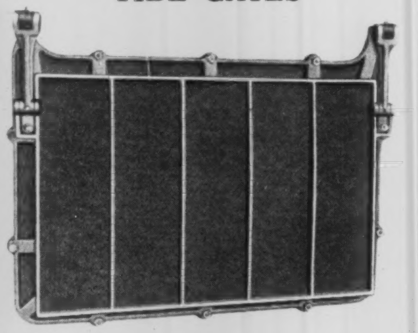

Fig. M-M

Made of all metal; upper hinge lugs are adjustable to provide correct seating even though foot walls are out of plumb; lower lip of nozzle is inclined downwardly and outwardly to increase velocity of very small flows to minimize deposit of sludge on seat; seats faced with non-corrosive metal if required; built to withstand back pressures due to 12′, 20′ and 40′ head.

Fig. M-M Gates are intended for use where conditions of free discharge normally exist.

Fig. M-M-C Gates have cellular shutters designed to weigh 70 pounds per cu. ft. of displacement. Recommended for use under conditions of submerged discharge.

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tests of sand moisture developed by Los Angeles Department of Water and Power for determining whether sand is up to specifications.

Road Materials. Road Materials. *Am. Soc. Testing Matls.—Proc.*, vol. 37, pt. 1, 1937, pp. 918–923. Tentative specifications for standard sizes of coarse aggregates for highway construction, concrete aggregates, and light-weight aggregate for concrete; tentative method of test for abrasion of gravel by use of Deval machine, and abrasion of coarse aggregate by use of Los Angeles machine.

MUNICIPAL ENGINEERING

Public Utilities, Underground. Location of Underground Utilities. *Am. Soc. Civ. Engrs.—Manuals of Eng. Practice No. 14*, 1937, 15 pp.; also special 15-page supp. Governing organization of underground planning units; standards for recording data; for preparation of underground plans and for office practice; standards of design; typical plans and forms for use in locating underground utilities. Bibliography.

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PORTS AND MARITIME STRUCTURES

Le Havre. Le Havre Fulfills Its Name. *Naut. Gaz.*, vol. 128, no. 15, July 30, 1938, pp. 5–7. Ancient history; data pertaining to port developments, facilities, and advantages.

Ostende. Les portes de la nouvelle écluse du port de peche d'Ostende. *Ossature Métallique*, vol. 6, no. 9, Sept. 1937, pp. 403–408. Structural details of steel gates of lock of new fishing port of Ostende, Belgium, 9 m wide, 11.5 m high.

Shore Protection, Germany. Kuestenschutz an der Ostsee, Hansen. *Bautechnik*, vol. 16, no. 4, Jan. 28, 1938, pp. 43–47. Review of coast protection practice along North Sea shore of Germany.

ROADS AND STREETS

Asphalt. Current Trends and Developments in Asphalt Highway Construction, J. E. Buchanan. *Western Construction News*, vol. 13, no. 7, July 1938, pp. 264–266. Review of two years progress in American practice in asphalt construction; noting application of soil technology to foundations; salvaging of obsolete highways and appreciation of need for improvement in asphalt technology; specification revisions; water control and erosion prevention; cooperation of colleges.

By-Pass. By-Pass Highways Relieve City Traffic. *Concrete*, vol. 46, no. 7, July 1938, p. 8. How by-passes constructed by North Carolina Highway Department, Durham, have relieved congested business districts and provided easy and direct access into city.

Causeways, Galveston, Tex. New Hurricane Bridge Design. *Eng. News-Rec.*, vol. 121, no. 11, Sept. 15, 1938, pp. 327–328. Description of new reinforced concrete causeway across Galveston Bay; 8,200-ft long; 48.5 ft wide; illustrating changed thinking in design of bridging to resist hurricane wave action.

Causeways, Galveston, Tex. Viaduct Built from Barges, J. E. Grace. *Eng. News-Rec.*, vol. 121, no. 11, Sept. 15, 1938, pp. 329–331. Abstract of paper before Texas Section of Society, describing methods of sinking caissons and construction of continuous girder units for new causeway over Galveston Bay; over 2 miles of viaduct and earth causeway were constructed by dredging parallel canal for light, fast-moving barge plant, from which construction operations were carried out.

Construction. Modern Highway Planning and Building, F. J. Grumm. *Western Construction News*, vol. 13, no. 9, Sept. 1938, pp. 322–326. Design and construction of section of Los Gatos–Santa Cruz Highway Calif., which will require excavation and disposal into fills of approximately 2,200,000 cu yd of earth and rock in distance of 6¼ miles; excavating equipment; drainage structures; principal unit bid items.

Erosion. Highway Fill-Slope Fixation Methods Developed by U. S. Forest Service, W. T. Corum. *Western Construction News*, vol. 13, no. 8, Aug. 1938, pp. 287–291. Review of modern construction practice of controlling erosion on fill slopes; drainage; pre-cast concrete cribbing; trenching; brush mat placing operations; cost of construction; experiments with mesh fabrics.

Lighting. Bridge and Highway Lighting in California, W. P. Bear. *Illum. Eng. Soc.—Trans.*, vol. 33, no. 8, Sept. 1938, pp. 705–724. Physical set-up of 32 miles of very high-class bridge and highway lighting described; influence of this lighting as it affects reduction in automobile traffic accidents and deaths is outlined; experience in collecting this information; series of statements as to elasticity of "Yardsticks" now used by many statisticians in presenting facts regarding traffic.

Maintenance and Repair. Resurfacing Streets for Service, G. C. DeWitt. *Eng. News-Rec.*, vol. 121, no. 13, Sept. 29, 1938, pp. 401–402. Experiences at Utica, New York, in reconstruction of worn-out pavement with bituminous materials; selection of surface; pavement widening.

Maintenance and Repair. Street Maintenance Operation in Philadelphia. *Pub. Works*, vol. 68, no. 10, Oct. 1937, pp. 53–55 and 59–60. Review of practice of Bureau of Highways of Philadelphia, Pa.; methods of supervision, organization of gangs, quality and quantity of work, reporting of time and other incidentals bearing on maintenance and repair of streets and roads; rainy days.

Maintenance and Repair. Technique of Winter Road Maintenance, A. Gratton. *Eng. & Contract. Rec.*, vol. 50, no. 96, Oct. 27, 1937, pp. 13–16. District engineer of Quebec Department of Roads discusses points that experience has shown to be important when preparing to keep highways open for year-round traffic; drift prevention; snow removal; selecting equipment; ice treatment.

Railroad Crossings. Railway Subway at Port Arthur, S. E. Flock. *Eng. & Contract. Rec.*, vol. 50, no. 86, Aug. 18, 1937, pp. 9–12. Description of grade separation structure in Port Arthur, Ontario, featuring rigid frame arch with ballast cushion under ties.

Research. Road Development in Great Britain, F. C. Cook. *Passenger Transport J.*, vol. 79, no. 1992, Sept. 9, 1938, pp. 101–103. Reports on work of Road Research Laboratory with reference to soil physics, road materials, resistance to skidding, influence of speed, and road safety.

Street Lighting. Street Lighting and Safety, L. J. Schrenk. *Illum. Eng. Soc.,—Trans.*, vol. 33, no. 8, Sept. 1938, pp. 687–704, supp. sheet. Summary of studies made of automobile traffic fatalities in city of Detroit, both before and after improvements were made in street lighting on nine of most hazardous portions of several main thoroughfares, with consequent reduction in number of night fatalities as result of improved seeing conditions.

Subsoils. Study of Road Subsoils, C. A. Hogentogler. *Pub. Roads*, vol. 19, no. 6, Aug. 1938, pp. 112–120. Determination of properties of subsoils; testing methods and equipment; influence of subsoil properties on road construction and on maintenance; use of subgrade survey and classification of soils based on performance; construction of "stabilized" road surface and base courses; construction of highway embankments; graded soil mixtures; stabilization with portland cement or with bituminous binders.

Testing. Study and Standard of Quality of Road Surface, R. H. Baldock. *Pub. Roads*, vol. 19, no. 6, Aug. 1938, pp. 101–111 and 121. American test data on slipperiness or ruggedness of road surfaces and their resistance to skidding; data on reflection or absorption of light from road surfaces; coefficients of friction for new-tread and smooth-tread tires skidding straight ahead and sideways; luminosity of various road surfaces when dry and when wet. Before 8th Int. Road Congress, June 19–July 2, 1938.

SEWERAGE AND SEWAGE DISPOSAL

Activated Carbon. Effects of Activated Carbon in Digestion of Fresh Solids—Activated Sludge Mixtures, G. E. Flower, C. B. Budd, and C. Hauck. *Sewage Works J.*, vol. 10, no. 3, May 1938, pp. 441–449. Experimental study at Southerly Sewage Treatment Plant, Cleveland, Ohio, of effect of activated carbon on odor control, digestion process, pH control, solids destruction; settleability of digested sludge as well as filtrability; possibility of economizing on dosages of ferric chloride and lime for sludge conditioning before filtration. Bibliography.

Activated Sludge. Studies on Clarification Stage of Activated Sludge Process—VIII, R. S. Ingols. *Sewage Works J.*, vol. 10, no. 3, May 1938, pp. 458–464. Experimental study of physical or biological factors that bring about uptake of soluble substances from solution, including hydrolysate of casein and glucose; adsorption of amino acids; effect of sodium chloride on uptake of amino acids and glucose; effect of glucose and chloroform on uptake of amino acids. Bibliography.

Chemical Process. Chemical Coagulation of Sewage—IX, W. Rudolfs and H. W. Gehm. *Sewage Works J.*, vol. 10, no. 3, May 1938, pp. 450–457. Order of addition of chemicals; experimental study of relationship between character of sewage and order of addition of chemicals of various values of pH.

Industrial Waste. Effect of Trade Wastes on Sewers and Treatment Works, S. Shupe. *Am. City*, vol. 53, no. 9, Sept. 1938, pp. 91 and 93. Effect of trade wastes from tanneries, meat packing plants, dairies, and gas manufacturing plants, with special reference to experience of Kitchener, Ontario. Before Can. Inst. on Sewage and Sanitation.

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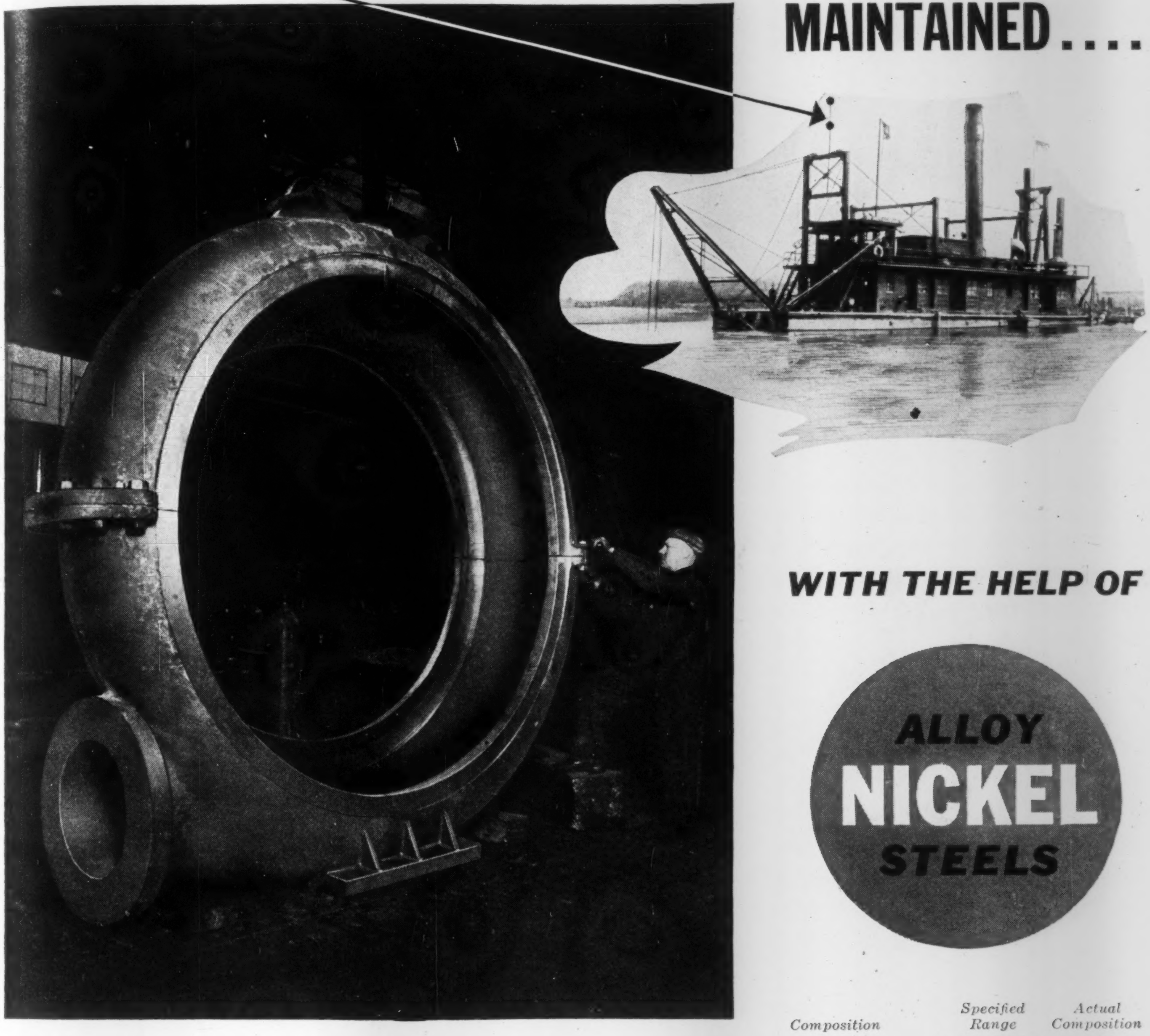

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Phosphorus and Sulphur	0.40% Max.	0.020%
Nickel	1.75/2.00%	1.86%
Chromium	0.60/0.90%	0.86%
Molybdenum	0.15/0.30%	0.25%

Physical Properties	*Specified Minima*	*Test Results*
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Tensile Strength (psi)	100,000	104,000
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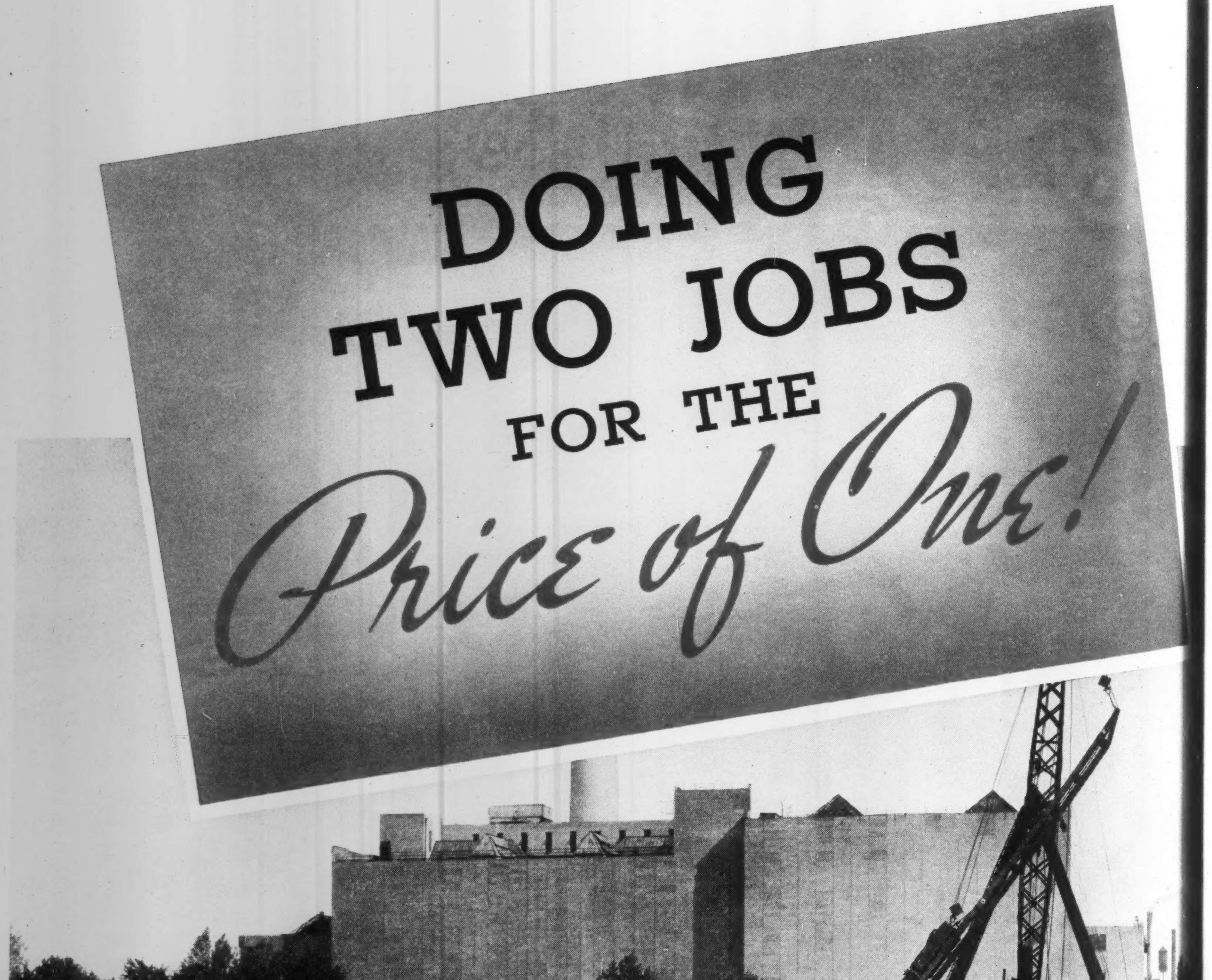
Reduction of Area	30.0%	39.7%

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

CIVIL ENGINEERING, December 1938. Vol. 8, No 12. Published monthly by the American Society of Civil Engineers. Publication office at 20th and Northampton Sts., Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 W. 39th St., New York, N. Y. Price 50c a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage 75c and foreign postage $1.50 additional. Entered as second class matter September 23, 1930, at the Post Office at Easton, Pa under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917 authorized on July 5, 1918.

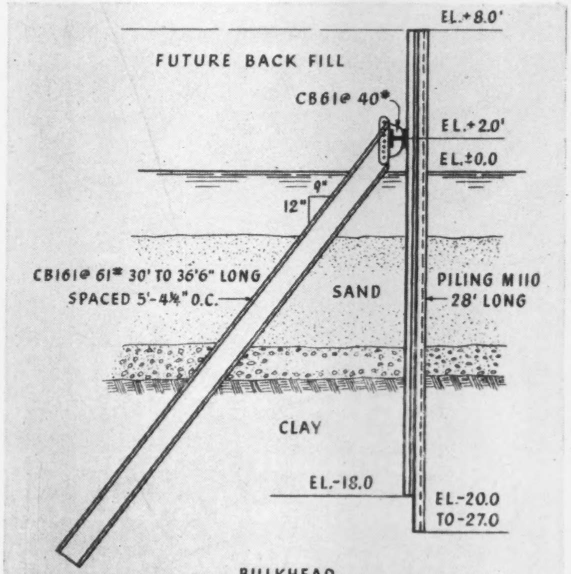

DOING
TWO JOBS
FOR THE
Price of One!
N. S. MACKIE COMPANY

In this construction, U·S·S Steel Bearing Piles (CB Section 161 weighing 61 lb. per ft.) and U·S·S Steel Sheet Piling (M110, with 6″ arch, 13/32″ web, 3/8″ flange, weighing 42.7 lb. per lin. ft.) were used as illustrated. Using McKiernan Terry Hammers 9B2 and 9B3 and Vulcan Hammer No. 1800, from 8 to 18 Bearing Piles—from 30 to 40 Steel Sheet Piling sections—were driven per day. General Contractors—N. S. Mackie Company; Consulting Engineers—Maritime Engineering Corporation.

. . . Interesting U·S·S Steel Sheet Piling application acts first as a breakwater, then as a bulkhead!

BUILT for the Northern Indiana Public Service Company in Michigan City, Indiana, this 2300 ft. bulkhead is designed to prevent plant waste from its generating station being discharged into Lake Michigan, and to build up land for future extension of the station.

The fact that the bulkhead extends far into the lake made orthodox tie-rod and anchor construction impractical here. So the consulting engineers, Maritime Engineering Corporation, decided to combine U·S·S Steel Sheet Piling and Bearing Piles in a construction that has proved both efficient and economical under similar conditions elsewhere. Cross-section and photograph clearly illustrate how the job was handled.



BULKHEAD
NORTHERN INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, IND.

U·S·S Steel Bearing Piles, spaced 5 ft. 4½ in. o.c. and varying in length from 30′ to 36′6″, were driven, as shown, through sand and gravel to resistance in clay bottom at an angle of about 34°. They act as supporting struts while the wall serves as a breakwater and will function as a tie-back system after the fill is completed.

U·S·S Steel Sheet Piling sections 28 ft. to 35 feet long were then driven well into the hard clay bottom, leaving a free board of 8 ft., and were tied to the steel struts, as illustrated, providing a construction that is simple, rugged and reasonable in cost.

• • •

To permit the most efficient solution of engineering problems involving coffer dam and pier construction—abutments or retaining walls — docks, sea-walls, jetties and groins, cut-offs under dams and similar structures, U·S·S Steel Sheet Piling is available in straight-web and arch-web sections, as well as our new "Z" sections, recently developed. And in U·S·S Steel Bearing Piles we offer you the strongest, most permanent, most easily driven form of bearing piles you can use. They are available from an unfailing source of supply that puts them on the job when you want them and in any quantity.

U·S·S STEEL BEARING PILES *and* PILING

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago

United States Steel Products Company, New York, *Export Distributors* · Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

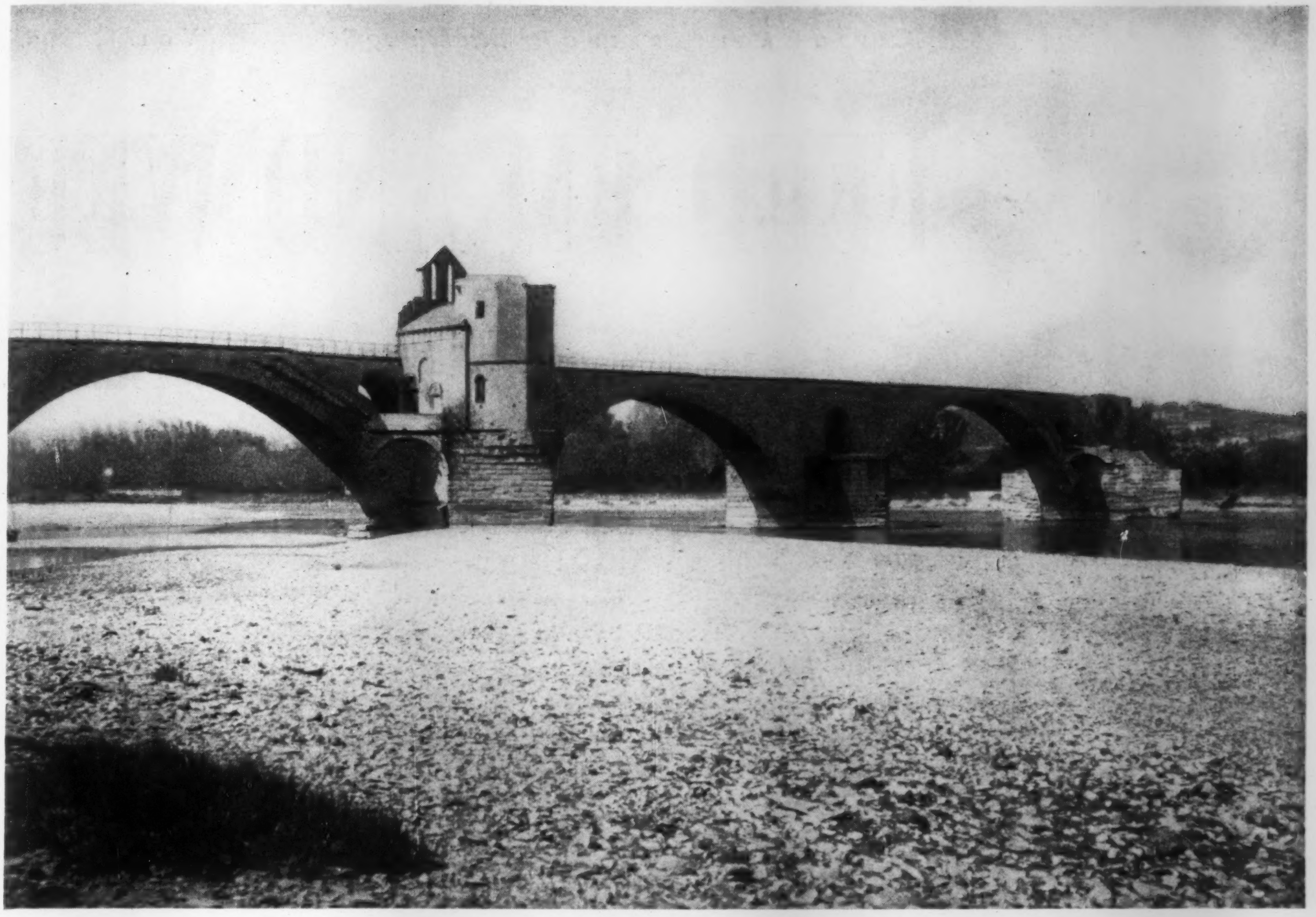
UNITED STATES STEEL

Raymond

CRASH! goes the big hammer, driving home not piles but the heavy Raymond steel shells into which concrete will be poured . . . thus forming Raymond Concrete Piles. No matter whether your concrete pile foundation job is large or small, the piles short or long . . . let us drive home one fact . . . you can depend on Raymond Concrete Piles.

RAYMOND CONCRETE PILE CO.

140 Cedar Street, New York, N.Y.



Pont d' Avignon

Built in the twelfth century by Bénézet, the part of this bridge shown here stands today as a reminder of the accomplishments of artisans of an age that was especially notable for the grandeur and splendor of its structural achievements. The photograph reproduced here was submitted by E. D. Kingman, Assoc. M. Am. Soc. C.E.

FEED 'EM AND WEEP

USE 'INCOR'—AND CUT HEAT-PROTECTION COSTS BY 50 TO 60%

IT pays to remember that the quicker concrete hardens the less time and expense are required to provide costly heat-protection. There's no profit in dumping coke into the greedy maw of a salamander.

'Incor' 24-Hour Cement saves real money on cold-weather work because it gains strength faster and the concrete is safe from freezing sooner. Heat mixing water and aggregates, as usual; then, with 'Incor'*, simply provide heat-protection for 24 hours after concrete is placed. That saves, at very least, two days' heat-curing. Typical example:

6-story-and-roof concrete-frame building —100' x 100' in plan

To provide heat: one salamander per 330 sq. ft., 30 salamanders per floor

Operating Costs:

Coke, 5 tons a day, at $10	$50 per day
Labor, 4 men tending fires, at $5	$20 per day
Heat cost	$70 per day

'Incor' Saves Heat-Protection Costs:

2 days' heating expense per floor	$140
For 6 stories and roof	$980

To these fuel and labor savings, also add reduced form costs and lower job overhead as well. Why not figure these savings on work now in progress? Write for copy of "Cold-Weather Concreting." Lone Star Cement Corporation, Room 2246, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.

LONE STAR CEMENT CORPORATION

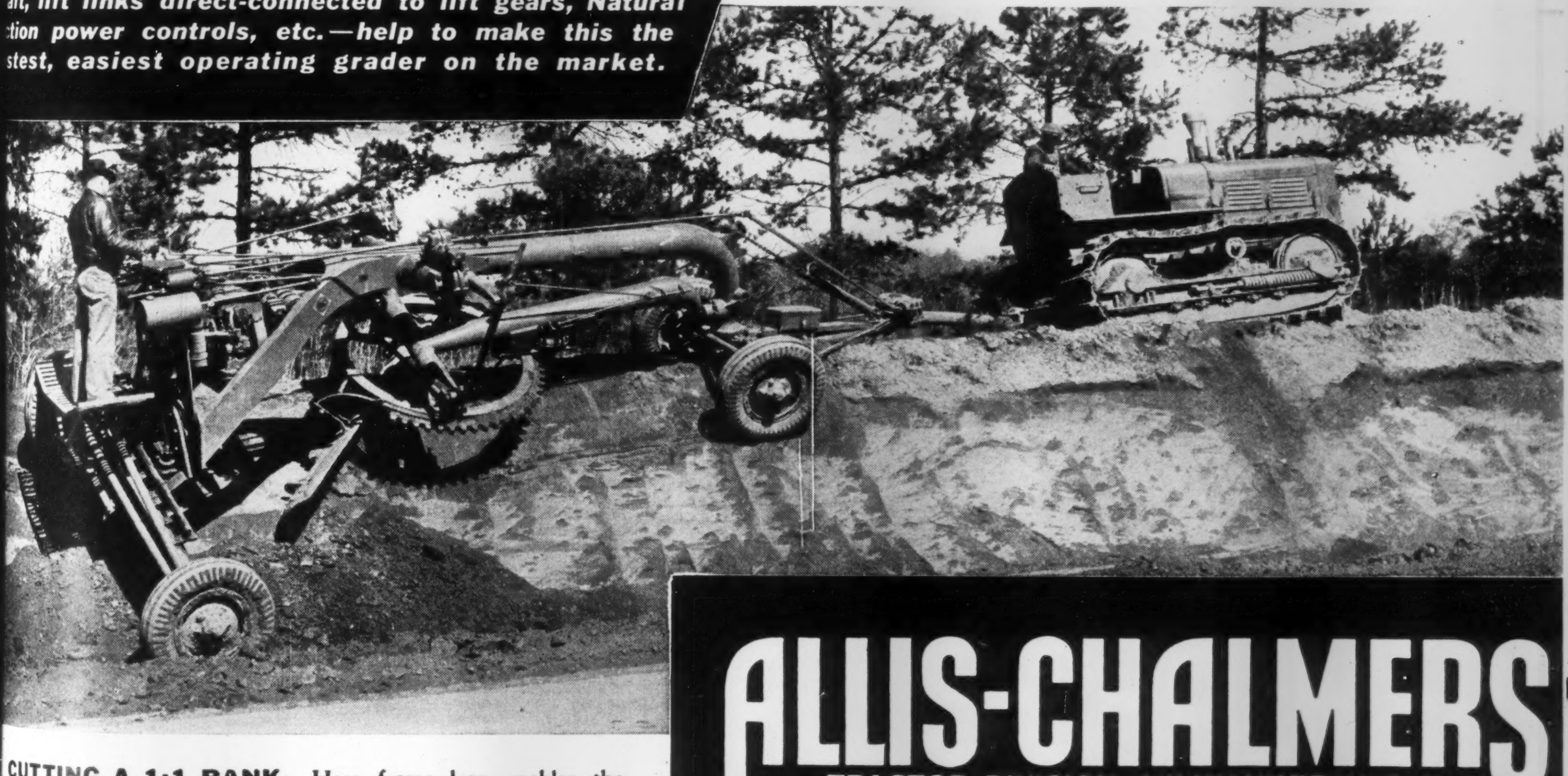
MAKERS OF LONE STAR CEMENT
'INCOR' 24-HOUR CEMENT

why YOU CAN DO MORE WORK WITH THE LEANING FRAME GRADER

NISHING FLAT BOTTOM DITCH. Frame lean enables the operator istribute weight evenly over all four wheels and at same time keep plat- n in a level, comfortable operating position.

You handle tough going more easily because you can lean the frame weight on the moldboard to gain extra blade pressure for cutting through hard spots or shearing off roots. You are able to shift the grader's center of gravity by using the frame lean and thus work on steep banks where other graders cannot even stick. Once the blade is set to the specified cross section, you obtain uniform slopes simply by keeping a level platform with the frame lean control. You make adjustments to clear culverts and other like obstructions almost instantly by simultaneous use of frame lean and lift arms—most small obstructions can be cleared by frame lean alone. Frame lean provides a greater range of working positions than has ever before been possible in a grader—and enables you to keep a level platform that's comfortable to work on regardless of grader position. Ask your Allis-Chalmers dealer for more complete details.

***vestigate the Leaning Frame**—See how these portant features—twist-proof tubular frame, low-line aft, lift links direct-connected to lift gears, Natural tion power controls, etc.—help to make this the stest, easiest operating grader on the market.*



CUTTING A 1:1 BANK. Here frame lean enables the operator to control the grader's weight so he can work on a bank too steep for ordinary graders to travel. Note comfortable pos

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

GASOLINE AND CONTROLLED IGNITION OIL TRACK-TYPE TRACTORS FROM 32 TO 80 DRAWBAR H. P.

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LENDS DISTINCTION
TO YOUR DRAWINGS . . .
NOPQRS

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Add Leroy lettering to your drafting room equipment. Your K & E dealer will be glad to arrange a demonstration—or write us for Booklet No. 46 and price list.

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REG. U. S. PAT. OFF.
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Extra Years of Service

are Built into This Pipe

Bituminous Material
Asbestos Fibres
Galvanized Metal
1
2
ARMCO INGOT IRON
GALVANIZED COATING
ASBESTOS FELT
ASPHALT SATURANT

1. In this photomicrograph you can see that the bituminous material is securely "keyed" to the galvanized iron.

2. Here is a cutaway view of Armco's Asbestos Bonded Sheet developed especially to grip and hold a bituminous coating.

• Whether you are designing a sewer, or a culvert structure that must withstand severe corrosive conditions—there are many reasons why you'll get a more permanent job with *Asbestos Bonded* Armco Paved Invert Pipe.

Here in this one pipe are all the structural advantages of corrugated metal, cinched by the 32-year service record of galvanized Armco Ingot Iron. In addition, *Asbestos Bonded* pipe is paved in the bottom where the wear comes, and heavily coated, with a special bituminous material. This special Armco material, proved by 13 years of continuous use, is securely bonded to the pipe by non-deteriorating asbestos fibres.

Detailed information about *Asbestos Bonded* Armco Pipe is quickly available. Just address: Armco Culvert Manufacturers Association, Middletown, Ohio.

ASBESTOS BONDED ARMCO **ARMCO PIPE**

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

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Gilmore Wire Rope, with a new plant, precision equipment and many years' experience, backed by outstanding metallurgical science, should give you much longer and satisfactory service, and thus save you money. Will you try it now? Send for catalog.

J&L STEEL

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Buff precision and design are continuously in the forefront.

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has the finest and highest definition and simplest lens system. It is useful when the light is dim.

Buff is used almost exclusively on the largest works in this country and Canada and Mexico and So. America.

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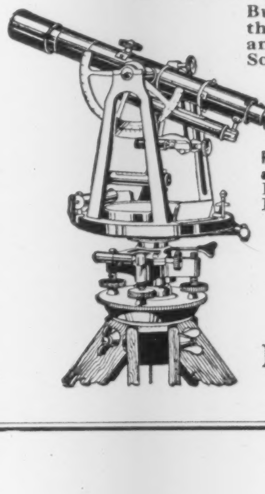
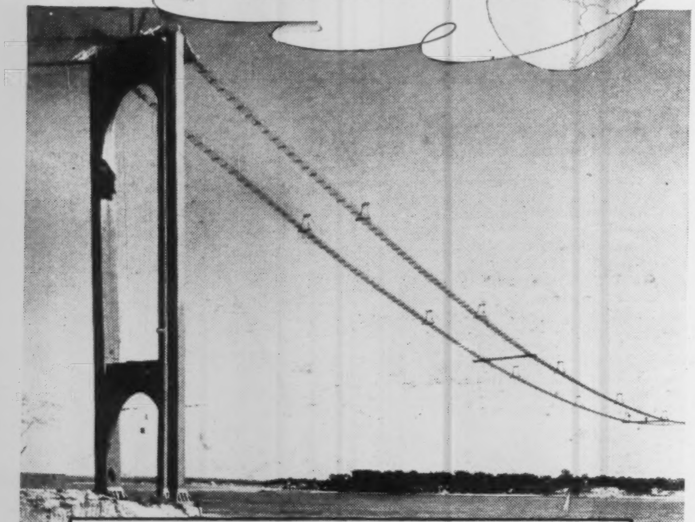
All makes—intelligently repaired and regraduated by Factory Experts. The **finest work** at the **LOWEST POSSIBLE COST.** Reliability and **guaranteed work.** A special Souvenir Plumb Bob sent gratis to graduate Civil Engineers.



THE Greatest ACCURACY
THE Hardest BRONZE
THE Simplest DESIGN

Buff & Buff Company
Jamaica Plain, Massachusetts

THE WORLD MOVES FORWARD WITH STEEL

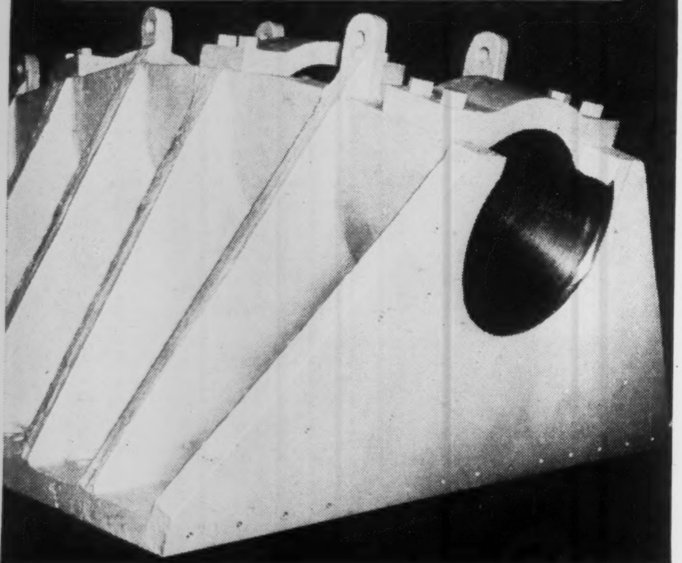


CABLE SADDLES

that help link another gateway to the World of Tomorrow

ATOP the Bronx Whitestone Bridge—another World's Fair gateway—are four cable saddle castings machined by Federal. They weigh about 20 tons each, were bored through an arc 14 feet long on a 15-foot radius, diameter of bore, 21-3/8".

Our large machine tools are frequently engaged in work of this character. Consult us on your heavy machining problems.



FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

Lincoln Highway, USS Kearny, New Jersey

UNITED STATES STEEL

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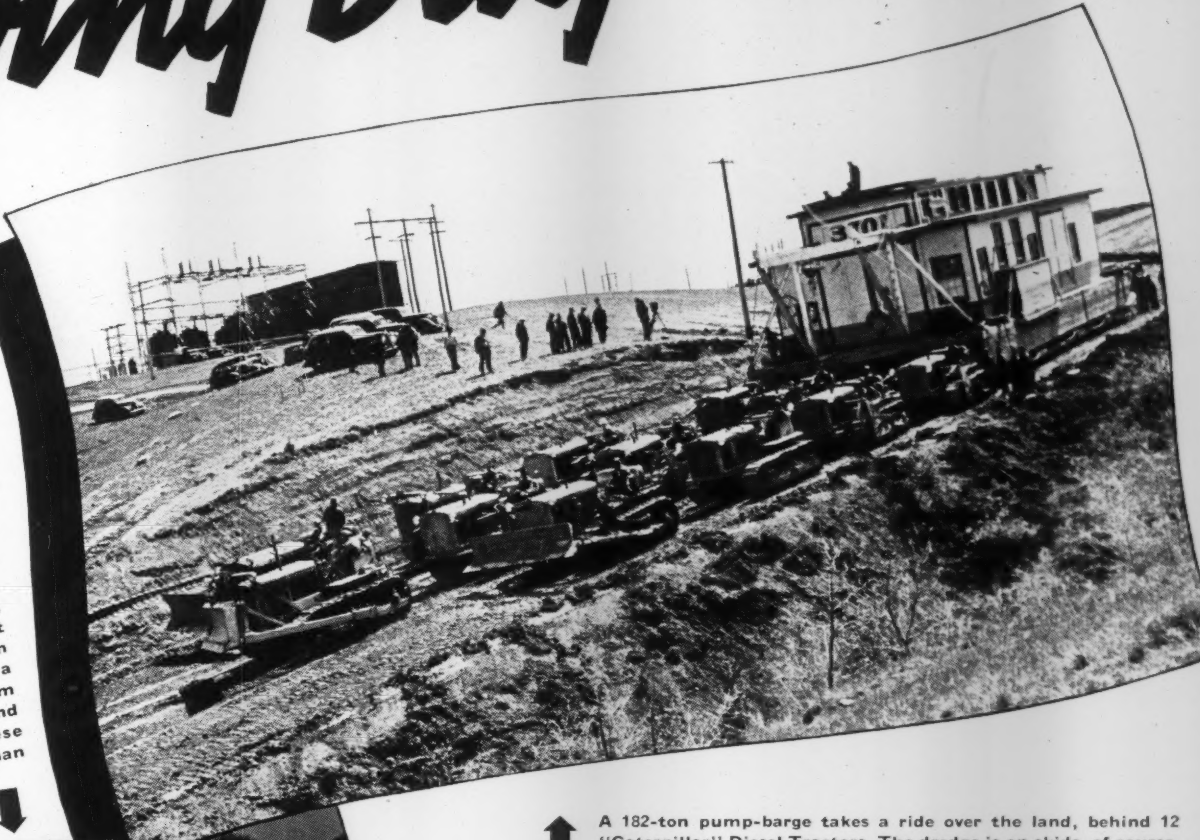
Moving Day FOR DREDGES TREES AND DIRT!



A 182-ton pump-barge takes a ride over the land, behind 12 "Caterpillar" Diesel Tractors. The dredge is on skids, of course. This is at the Fort Peck Dam, near Glasgow, Montana. A real pull for hilly country!

These trees—on Treasure Island, at the International Golden Gate Exposition—weigh as much as 38 tons apiece! When the job is completed, 3200 will have been transplanted. But that isn't so much of a task, when "Caterpillar" Diesel Tractors lend a hand. To get one tree unloaded from the dock . . . into the ground . . . and covered, with the help of these "Caterpillar" Diesels, takes less than 30 minutes!

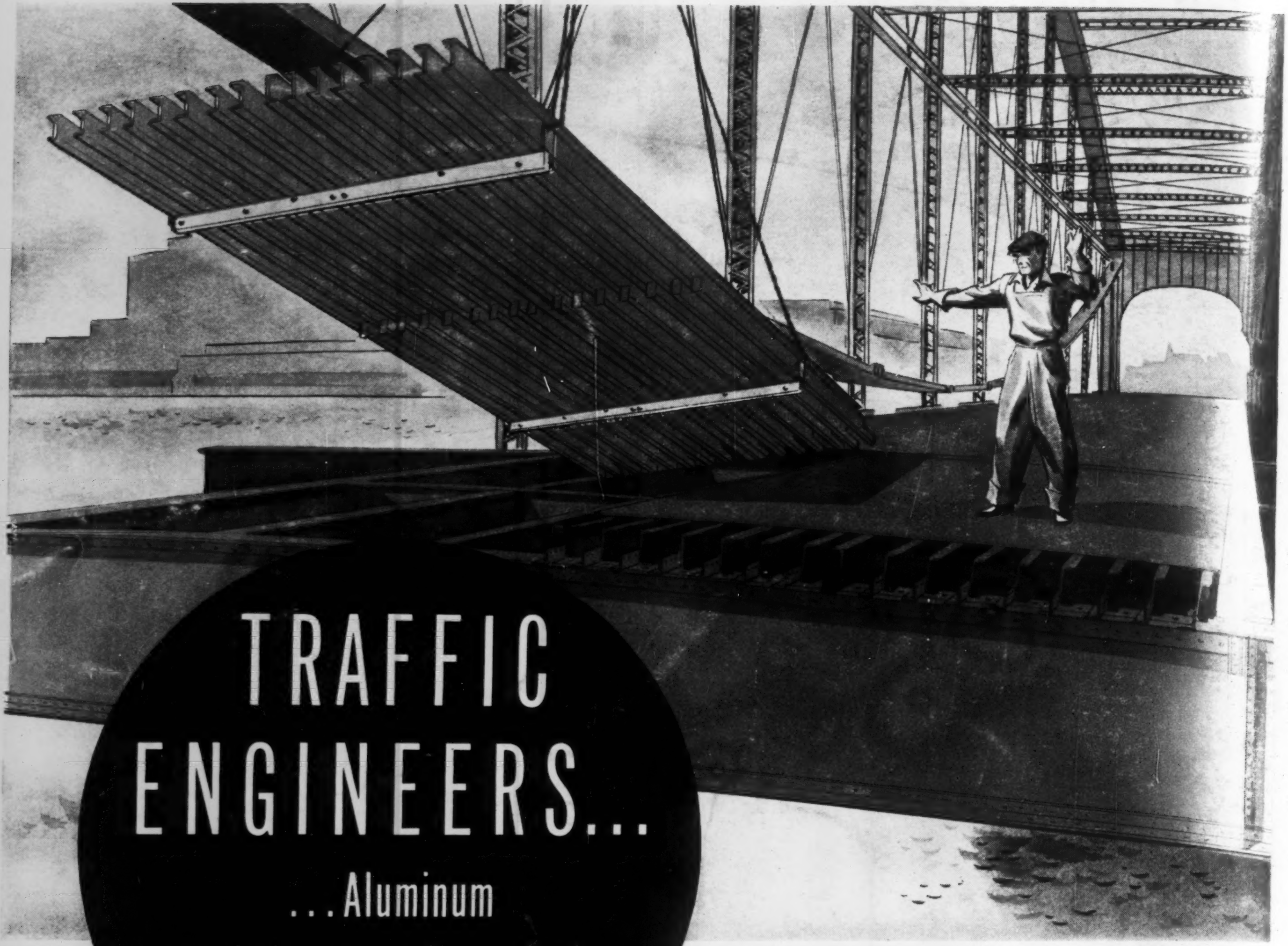
Moving dirt—and really moving it!—on the Altamont Pass, California. To help straighten this road, a fleet of "Caterpillar" Diesel Tractors worked 14 hours a day . . . and, in those 14 hours (on the particular section pictured here), each outfit carried 336 cubic yards of dirt on a haul of 3600 feet, each way!

WHENEVER you have something . . . *anything* . . . that has to be moved from HERE to THERE, don't make any false starts. Use a "Caterpillar" Diesel Tractor!

Here is drawbar power . . . plus traction geared to the ground . . . that seems to know how to handle any load that looks stubborn! And while *pull* is the first rule for hauling, that's only one thing that puts profit in your pocket.

You'll find there's money to be made through a "Caterpillar" Diesel Tractor's *low* consumption of *low-cost* fuel . . . through its rugged, enduring construction that *cuts the cost and time* of maintenance and repairs . . . through its *long life* that lets you spread the original purchase-price over *many years* of hard, useful service. Those are the things that make contractors realize it takes *less* money to *make* money—with "Caterpillar" Diesels!

CATERPILLAR
REG. U.S. PAT. OFF.
TRACTOR CO., PEORIA, ILL



TRAFFIC ENGINEERS...

...Aluminum can help you relieve bridge bottlenecks

Those bridges that are fast becoming loaded to capacity . . . Have you considered reducing their deadweight so that more live load can be moved over them? It's being done regularly with the help of lightweight Alcoa Aluminum Alloys.

The biggest job a bridge has is supporting itself, its own deadweight. Reduce that non-pay load, by using Aluminum for many of the parts supported, and you can widen roadways, add walks for pedestrians, strengthen railings—all at no expense to existing safety factors, and at a fraction of the cost for a new bridge.

You can apply this same principle on new, long span construction. By taking advantage of the weight-saving property of Aluminum in designing floor structures, for example, sizeable savings should result in the cost of piers and supporting members.

Alcoa engineers will gladly work with you to help determine where Aluminum can be used to best advantage on new and existing structures. ALUMINUM COMPANY OF AMERICA, 2127 Gulf Building, Pittsburgh, Pennsylvania.

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